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Training requirements were projected using survey data of agricultural employment needs and the number of students in agriculture in France and Sweden. Independent studies in each country investigated recent trends in agriculture, the present situation in agricultural education, employment training needs, and implications for the future. Projection methods used were analyzed. Conclusions were: (1) The present lack of data in rural education should be remedied, (2) Improved methods of forecasting the demand for agriculturally trained personnel are needed, and (3) Improved methods should be devised to measure the productivity of agricultural training. Essential types of data needed concerned manpower in agriculture, manpower in related agricultural activities, educational supply and demand, and educational resources. Further research was recommended on (1) methodology of projecting manpower supply and demand, (2) productivity of investment in agricultural education, (3) comparative advantages of differences in school size, class size, and course duration, (4) pedagogic problems of training, (5) other pedagogic problems, (6) relationships between training level and syllabus content, and (7) impacts of alternative syllabuses on resource needs in terms of buildings, equipment, textbooks, teaching, and auxiliary staff. (DM)

DOCUMENTATION IN AGRICULTURE AND FOOD

80

trained manpower for to-morrow's agriculture

VT005625

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
PARIS 1966

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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trained manpower for to-morrow's agriculture

A report on pilot studies in France and Sweden on projecting future needs for people with agricultural training and on planning the educational investment required to meet those needs

ED023833

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

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- *to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development;*
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FOREWORD

During the past five years, the OECD Division for Technical Action of the Directorate for Agriculture and Food has been carrying out a programme of activities[1] concerned with the full employment of human resources as the basis of rural development and of overall economic growth. This programme has laid particular stress on education and vocational training in agriculture[2], on advisory work[3] and on certain methods of analysis, decision-making and organisation which can make a major contribution to improving the economic efficiency of agriculture[4].

In the years 1960 to 1962, a general survey was made, published under the title "Intellectual Investment in Agriculture for Economic and Social Development "[5] One chapter of that report deals in particular with the planning of rural education (in the broad sense) in relation to agricultural progress and economic and social development. In 1963, a training course on the planning of agricultural education was held in Athens[6]. In order to explore further the problems of planning technical and vocational training for agriculture, and to devise practical methods for the use of governments, the OECD undertook in 1964-1965 two pilot studies on France and Sweden, respectively. The results of these studies are set out in the present report.

Much work has been done under the auspices of the OECD Committee for Scientific and Technical Personnel on the general problems of manpower forecasting and of educational planning in the light of the likely future size and composition of the labour force. This work has naturally given some attention to the agricultural sector as one among others, but the two pilot studies in the present report are of particular interest in that they are devoted wholly to this one sector which (together with certain ancillary sub-sectors) they consider in greater depth than is possible in studies covering the entire economy. These pilot studies necessarily take account of likely developments in other sectors insofar as they are relevant to agriculture: thus, depending on national policy for the relationship between domestic production on the one hand, and domestic and overseas market outlets on the other, some assumption is made (implicitly or explicitly) about the probable effect of rising populations and per caput incomes on the trend of total farm output; account is taken of the likely effect of growth in the secondary and tertiary sectors on the rate of out-migration of labour from agriculture; and consideration is given also to the estimated requirements of agricultural know-how among part of the labour force outside the agricultural sector as narrowly defined.

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[1] The following publications in the series "Documentation in Agriculture and Food" are given to illustrate this programme. They are classified by subject matter.

[2] No. 38. The Professional Training of Teachers in Vocational Agricultural Schools, 1961.
No. 48. The Development of Agricultural Apprenticeship Schemes, 1962.
No. 52. Agricultural Vocational Training in Europe and North America, 1962.
No. 61. Higher Education in Agriculture—Report of the 1962 Conference.
No. 70. Agricultural Education at University Level, 1965.

[3] No. 36. Agricultural Advisory Services in Europe and North America (1960), 1961.
No. 62. Agricultural Advisory Services in Europe and North America (1963).

[4] No. 45. Programme Planning, 1961.
No. 49. Work Planning Methods in Agriculture and Horticulture, 1961.
No. 65. Co-operation between Research in Agricultural Natural Sciences and Agricultural Economics, 1964.

[5] No. 60 in the series "Documentation in Agriculture and Food", (1963), 151 pp.

[6] OECD.—Training Course on the Planning of Agricultural Education, AGR/T (64)15, 86 pp. (duplicated).

The pilot study on France was made by Mr. L. Malassis, Professor of Agricultural Economics at the Ecole Nationale Supérieure Agronomique de Rennes and OECD Consultant for the overall project, and that on Sweden by Mr. G. Ericsson, of the Agricultural Education Division of the Swedish Board of Agriculture and Dr. F. Petrini, of the Department of Rural Economics at the Uppsala College of Agriculture. The Swedish experts wish to place on record their appreciation of the invaluable help given by Mr. E. Oldgren and Mr. B. Sturén in the preparation of the Swedish study. The two country studies are followed by a comparative analysis of the projection methods used and a synoptic table on methods and sources, supplemented by two appendices that consider in more detail some problems encountered in connection with these studies. This part of the report was prepared by Mr. W.N.T. Roberts, Statistician to the Directorate for Agriculture and Food of OECD. The three country experts wish to express their appreciation of his work not only in preparing this very clear analysis of the methodological problems but also in contributing to the clarification of numerous points during the discussions on the draft country reports. Finally, there is a chapter containing the unanimous conclusions and recommendations of the participants in this exercise, and an appendix on analysing the present and future stock of graduates and technicians.

The country reports examine (in their respective national contexts) the structure of agricultural education and its relationship to the general educational system, and consider the problems of assessing the educational attainments of the present labour force in agriculture and its associated activities (such as firms supplying goods and services to farmers, and marketing or processing farm products). They then set out a number of possible bases for projecting the future labour force both in total and sub-divided by broad functional groups, and endeavour to assess the educational levels needed for the proper fulfilment of these functions. The next stage is to derive, from these 'manpower stock' estimates for about 1980, the corresponding annual 'manpower flows' that would be needed between now and 1980 in order to achieve the projected 'stock' levels by about that time. These estimates of the annual flow into the labour force are then considered in terms of the corresponding annual flow out of the agricultural educational system (with some allowance for successful students who do not seek a job in or connected with agriculture), and this outflow from the training system is then expressed in terms of the total 'stock' of pupils in training institutions (with some allowance for students who do not complete their course). The last stage is to examine the financial implications of the education programme, in terms of the costs of provision and maintenance of buildings, equipment and personnel.

The country studies themselves make clear that the problems in practice are much less straightforward than this over-simplified summary suggests. The authors encountered many methodological difficulties, not least because of the lack of adequate basic statistics. Data on agricultural training are dispersed, fragmentary and lack homogeneity, and a better knowledge of the present situation is a prerequisite of usable educational planning. The authors cannot over-emphasize the fact that there is a fundamental need to improve statistics (at both the national and the international levels) on agricultural manpower, its functions and its education.

It must be pointed out that although the authors have tried to propose a "reasonable" programme for the development of agricultural training, bearing in mind the present situation and general socio-economic trends, the proposals made in this report may differ from those advanced at official level. *The authors, in agreement with the OECD, wish to stress the methodological nature of their work, which in no way commits the governments concerned, and for which sole responsibility is borne by the experts who were deemed to be independent for the purposes of the study assigned to them.*

The OECD wishes to express its gratitude to the country experts, and to the authorities for whom they normally work, for all that they have done to make this report a very significant contribution to the body of knowledge in this poorly documented part of the whole field of education as a form of investment for economic growth.

COUNTRY PILOT STUDIES

FRANCE

by

L. MALASSIS

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FRANCE

by

L. MALASSIS

I. RECENT TRENDS IN FRENCH AGRICULTURE[1]

1. During the period 1950-1960, France's gross domestic product increased by some 56 per cent and agricultural output by 31 per cent. General economic growth having been faster than agricultural growth, the historical trend of "the relative decline of agriculture" has been confirmed over the last ten years since the agricultural product as a percentage of the national product at constant prices fell from 12 per cent in 1950/51 to 9 per cent in 1961/62. This relative decline has been accompanied by an absolute rate of growth in agriculture (of the order of 3 per cent per year) at a far higher rate than that recorded in the first half of the 20th century.

2. Agricultural output depends on a number of factors. It may be conveniently described as a function of the cultivated *area* (S), the *labour* force (T), fixed *capital* (C), *current purchases* by agriculture from other sectors of the economy (fertilizers, fuel, pest and weed control items, etc.) (A), and the productivity of each of these factors individually (land, labour, etc.) or combined (the rise in global productivity being the measure of progress) (P_g):

$$P_a = f(S, T, C, A, P_g)$$

3. During the period under review, the area of agricultural land declined to a small extent, while the agricultural population fell by 25 per cent (1954-1962). The growth in agricultural output results therefore from a twofold accumulation of *physical capital* (especially by purchases from other economic sectors) and of *knowledge* (technological progress and better management).

4. The statistics available do not allow a proper estimate of the growing capital intensity of agriculture or of the relative importance of the factors contributing to it. Nevertheless, some valuable indications are given by figures for increases in livestock, machinery and tractors. Over the period from 1950 to 1960, gross fixed capital formation in the form of new machinery and equipment approximately doubled. Current purchases from other sectors showed a considerable increase. These purchases, expressed as a percentage of agricultural output, rose from 19 per cent in 1950-52 to 23 per cent in 1960.

5. Since the agricultural population is declining and the capital invested in agriculture is increasing, it follows that the capital invested per person employed

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[1] The figures quoted in this chapter are based on national accounts studies and are taken from various statistical publications.

is growing rapidly. The capital invested per person employed in agriculture is now equivalent to and sometimes larger than that in the non-agricultural sector: farming has become a heavy industry[1].

6. Agricultural progress, measured by the increase in factor productivity (total output divided by one production factor) or by global productivity (total output divided by the sum of all production factors), has been very considerable in recent years: global productivity has risen more rapidly in agriculture than in other economic sectors.

7. The growth of agricultural output combined with a fall in the active agricultural population has led to a rapid increase in the productivity of agricultural labour. During the period from 1950 to 1960, labour productivity rose by 55 per cent in the French economy as a whole and by 83 per cent in agriculture. This increase in the productivity of labour implies an increasingly skilled agricultural work force (a better use of human resources), the use of more advanced means and methods (technological progress), and better organisation of production (improvement of farm structure and better balance and use of resources).

8. The process of change in farm structure encounters many points of resistance and is historically slow. In 1955 (the most recent farm census), 30 per cent of holdings of 1 hectare and over were less than 5 hectares, and *53 per cent of them less than 10 hectares.* An analysis of the trend in farm sizes between the 1942 and the 1955 censuses shows that there have been rapid changes during recent years. "Large farms are becoming more numerous everywhere. Medium-sized farms are, in many cases, on the increase too, but there are also many instances where their number is declining to the benefit of the larger farms. There are only a few regions where the number of small farms, between 10 and 20 hectares, is also on the increase, and where only those of less than 10 hectares are diminishing. In any event it is clear that in certain départements where the number of farms of 10 hectares or more is growing, relatively intensive farming systems are being practised. This being so, a farm of between 10 and 20 hectares can no longer be described as a small farm."[2]

9. The growth of farm size is only one of the structural changes which are taking place in French agriculture. Links between farms, processing firms and the food industry are becoming stronger, either as the result of a 'capitalistic' integration and other contractual arrangements or by a 'co-operative' process (considerable development of the co-operative movement combined with the introduction of new techniques), and new socio-economic forms of production have appeared (e.g. syndicate farming). Most of these changes are related to the process of 'industrialisation' of agriculture. The new forms of a highly productive agriculture consisting of specialised units linked together by integration and other contractual arrangements are emerging more clearly. A fundamental issue is whether agriculture will be integrated by industrial and commercial capitalism or whether it will prove capable of becoming an 'economic partner' within new co-operative groupings.

10. To sum up, the process of agricultural growth in France in recent years has been characterised by a twofold accumulation of physical and intellectual

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[1] FAO/ECE, *Towards a Capital Intensive Agriculture*, Geneva, 1961.

[2] From Klatzmann, "Aspects du développement de l'agriculture en France" (EEC, *Conditions de production de l'agriculture*, No. 11).

capital. The foundations of this process are therefore physical and intellectual investment. In future, agricultural growth and rural development will require forecasting or planning not only of 'physical' investment, but of 'intellectual' investment. The purpose of this report is to study the issues raised more particularly by the planning of agricultural training.

II. THE PRESENT SITUATION WITH REGARD TO AGRICULTURAL VOCATIONAL TRAINING

1. THE GENERAL ORGANISATION OF EDUCATION

11. For historical and socio-political reasons, and because of educational requirements and the need to adjust to socio-economic trends, educational systems are complex and varied. This chapter will simply describe the basic principles governing the French educational system, in order to show how agricultural training fits into the general picture.

12. In accordance with the principles laid down in the Constitution, the State affirms and respects the idea of freedom of education (coexistence of both state and private schools), education is compulsory and State education is free, and official degrees, certificates and diplomas are awarded by the State through public examinations.

13. The present organisation of *general* and *technical* education is based on the reform introduced on 6th January, 1959.[1] The purpose of this reform was to raise the school-leaving age (schooling up to 16 years being compulsory for all children entering primary school as from 1959), to promote democratisation, and to introduce certain changes in the educational system (such as breaking down 'compartmentalisation' of the teaching programme, reorganising and co-ordinating curricula, establishing equivalences, etc.), streaming and 'rechanneling' of pupils (observation and streaming, the postponement to after the age of 15 of most of the technical and professional specialised courses, and the introduction of 'reception' classes).

14. Compulsory education is in three parts (Chart No. 1 - I): elementary (lasting five years, from the ages of six to eleven), observation (two years, from eleven to thirteen); and terminal (marking the end, at age sixteen, of compulsory schooling). On completing the elementary part, pupils may follow the general education stream (Chart No. 1 - II) where they go through an 'observation' phase (1st and 2nd Forms), followed by a 'streaming' phase (3rd and 4th Forms), finishing their secondary education either by the *short* course (5th Form, leading to the Brévet général or ordinary general certificate of education) or by the *long* course (Terminal classes, leading to the Baccalauréat or advanced general certificate of education). The short course is provided by *collèges d'enseignement général* and the long course by *lycées d'enseignement général.*

15. The structure of *technical education* (Chart No. 1 – III) is similar (collège technique and lycée technique), and students work for a "certificate of

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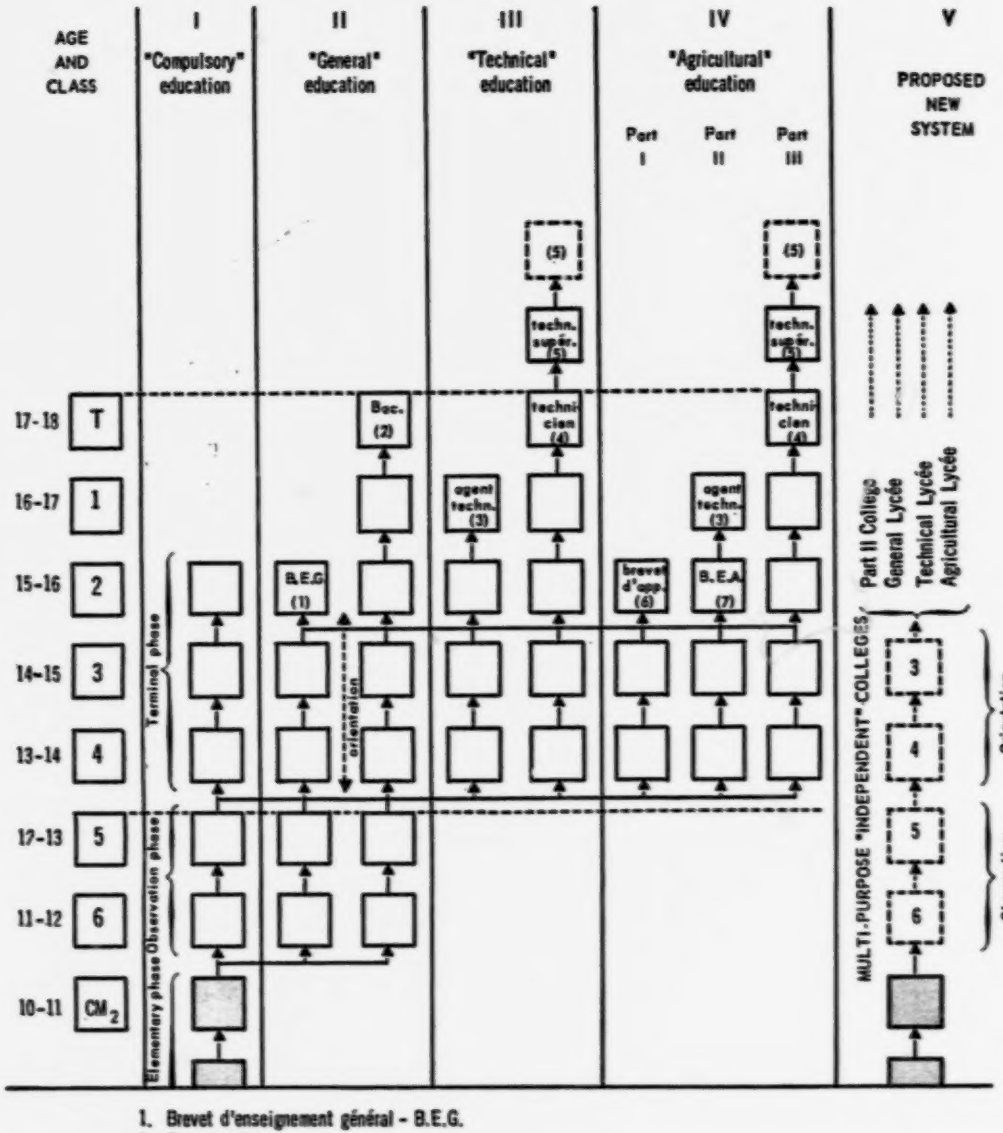
[1] Cf. Chart 1.

Chart 1. GENERAL STRUCTURE OF SECONDARY EDUCATION IN FRANCE


AGE AND CLASS
I "Compulsory" education
II "General" education
III "Technical" education
IV "Agricultural" education
Part I
Part II
Part III
V PROPOSED NEW SYSTEM
17-18 T
16-17 1
15-16 2
14-15 3
13-14 4
12-13 5
11-12 6
10-11 CM2
Elementary phase
Observation phase
Terminal phase
orientation
B.E.G. (1)
Bac. (2)
agent techn. (3)
technicien (4)
techn. supér. (5)
(5)
brevet d'app. (6)
B.E.A. (7)
MULTI-PURPOSE "INDEPENDENT" COLLEGES
Part II College
General Lycée
Technical Lycée
Agricultural Lycée
Orientation
Observation

1. Brevet d'enseignement général - B.E.G.
2. Baccalauréat.
3. Brevet d'agent technique.
4. Brevet de technicien.
5. Technicien supérieur.
6. Brevet d'apprentissage.
7. Brevet d'enseignement agricole - B.E.A.

professional aptitude", the *Brevet d'agent technique* and the *Brevet de technicien*. Provision is made for 'equivalences' and the possibility of transfer between the general and technical streams.

16. Since 1959, the marked increase in school enrolments and the need constantly to re-adapt to rapidly changing socio-economic conditions have led to some alterations in the 1959 reforms. These are, however, governed by pedagogical considerations relating to the development of children under the age of 18. This development is considered in three stages: basic acquisition of means of expression—language and arithmetic (primary school); observation and guidance (1st part of secondary education, Chart No. 1, from 1st to 4th Forms inclusive); and specialisation (5th Form up to terminal classes).

17. Rector Capelle has advocated the creation of "multi-purpose and 'independent' schools for the first part of secondary education": '*multi-purpose*' so as to facilitate the transfer of children from one class to another in keeping with their development and display of aptitudes; '*independent*', "i.e. independent of the primary school before them and of the more specialised schools which come after, so that the education they give is not influenced by external factors or by any preconception about the pupil's future".[1] These schools should make substantial provision for *general* education to cater for the needs of a changing situation.

18. Adoption of these proposals would mean that pupils at present attending *specialised* schools would all attend multi-purpose schools for the first part of their secondary education, where the basic education given would be such as to facilitate subsequent guidance and 'streaming' of the pupils (Chart No. 1-V). These multi-purpose and 'independent' schools would precede the specialised schools for the second part of secondary education (i.e. general, technical and agricultural).

19. A number of multi-purpose colleges have in fact been instituted, and a Decree of 10th June, 1965, has amended the Decree of 6th January, 1959. Chart No. 1 nevertheless remains valid, but a new feature is that a "baccalauréat de technicien" has now replaced the "brevet de technicien" and will provide access to higher education in accordance with a procedure to be worked out.

2. ORGANISATION OF AGRICULTURAL EDUCATION AND TRAINING

20. The purpose of agricultural education is to train farmers and farm workers, technicians and graduates for government, professional and private services and for both the agricultural sector and other sectors which employ agricultural graduates and technicians. For the sake of clarity, we shall deal first with secondary education and agricultural training, and then with higher education.

a) *Secondary education and agricultural training*

21. The main object of the reform of agricultural education (under the Law of 2nd August, 1960, and the Decree of 20th June, 1961) was to fit agricultural education into the national educational system (as established by the January,

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[1] Paper read to the *Congrès de la Confédération de la Coopération, de la Mutualité et du Crédit Agricoles*, Evian (1964).

1959 reform), to facilitate streaming and re-channeling, to institute 'analogous' educational establishments awarding 'equivalent' qualifications, and to construct a coherent and progressive whole. Young people who wish to go into agriculture can choose between four alternatives: the terminal course (which consists of further general education and also provides a grounding in agricultural subjects); *Part I* of the agricultural education course (leading to the "brevet d'apprentissage"); *Part II* (leading to the "brevet d'enseignement agricole" or the "brevet d'agent technique"); *Part III* (leading to the "brevet de technicien") (Chart No. 1-IV).

22. Chart No. 1 provides an outline of the structure of each of the three streams of education (general, technical and agricultural), and of the possibilities of transfer and the equivalences which link them together. The "brevet de technicien agricole" is equivalent to the "brevet" awarded in industrial subjects and, like the latter, provides access to higher education in accordance with a certain procedure. It is probable that the "brevet d'agent technique agricole" will be recognised as equivalent to the similar qualification awarded in industrial and commercial subjects.[1] The "brevet d'apprentissage" is equivalent to the C.A.P. (Certificat d'aptitude professionnelle) awarded in industrial or commercial subjects.

23. This system of equivalence between the general stream of education and the various technical streams, together with the possibilities of streaming and rechanneling during training (Chart No. 1), the prospect of moving from one level to a higher one and of entering university or equivalent establishments after taking an agricultural course, show that the reform of 2nd August, 1960, and subsequent amendments have enabled agricultural secondary education to be made into a coherent and progressive whole which fits more neatly into the general educational system.

24. Agricultural education is provided by State and by private establishments. The private sector is tending to conform to the structures resulting from the law reforming agricultural education. Under the law of 31st December, 1959, private colleges or schools of the same categories as State establishments and which have been recognised by the State may receive its financial assistance; official degrees and diplomas are awarded by the State following public examination. These private institutions may, however, preserve their own structures and teaching methods.

25. *Agricultural vocational training* is designed for those under 17 years of age who intend to go into agriculture and are not pursuing other courses of study. More generally, it is available to all those who, regardless of their age or other qualifications, wish at any time to improve their professional knowledge. Training may be given by State or private schools or by means of courses, organised either on a permanent or a seasonal basis. Successful students are awarded the 'brevet professionnel'.

b) *Higher education in agriculture*

26. The present structure of higher education in agriculture is the outcome of a historical process. It is currently governed by the provisions of the law of

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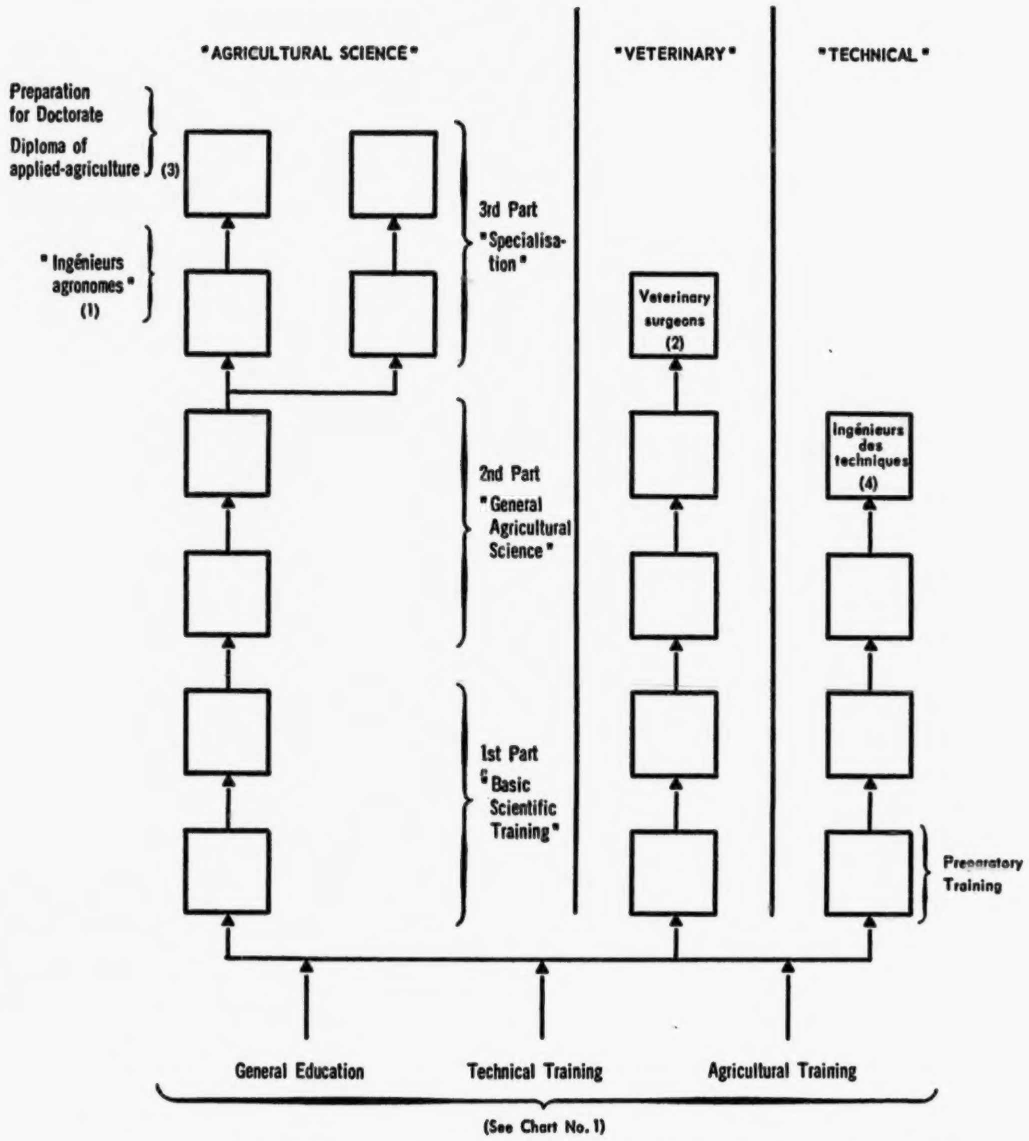
[1] *Bulletin d'Information du Ministère de l'Agriculture*, No. 203, Paris, 17th October, 1964.

Chart 2. THE STRUCTURE OF HIGHER EDUCATION FOR AGRICULTURE IN FRANCE


"AGRICULTURAL SCIENCE"
"VETERINARY"
"TECHNICAL"
Preparation for Doctorate
Diploma of applied-agriculture (3)
"Ingénieurs agronomes" (1)
3rd Part "Specialisation"
2nd Part "General Agricultural Science"
1st Part "Basic Scientific Training"
Veterinary surgeons (2)
Ingénieurs des techniques (4)
Preparatory Training
General Education
Technical Training
Agricultural Training
(See Chart No. 1)

1. "Ingénieurs agronomes": Institut National Agronomique (Paris), Ecoles Nationales Supérieures Agronomiques of Grignon, Montpellier, Rennes, Toulouse and Nancy;
   "Ingénieurs des industries Agricoles et Alimentaires": Douai and Massy;
   "Ingénieurs Horticoles": Versailles.
2. Alfort, Lyon, Toulouse.
3. Ecole des Ingénieurs du Génie Rural et des Eaux et Forêts.
4. "Ingénieurs Techniques" or "Ingénieurs des Travaux": Ecoles Publiques at Bordeaux, Barres and Strasbourg (teaching currently being developed); Ecoles Privées at Angers, Beauvais and Purpan.

2nd August, 1960, and the enacting decree of 20th June, 1961. By analogy with secondary education, a convenient distinction can be made between the short course (4 years) and the long course (5 years or more) of higher education. However, the difference lies not only in the length of the courses, but also in the level of the qualification and in the aims pursued (competitive entrance examination; orientation and level of teaching).

27. Higher education is provided by State or private establishments with a general or a specialised curriculum. The diplomas awarded to successful students are those of "Ingénieur des techniques" (short course), "Ingénienieur agronome" (long course) or veterinary surgeon. The "Ingénieurs agronomes" may go on to prepare a Doctor's thesis (third Cycle) or to work for a diploma of "Ingénieur spécialisé" in colleges of applied agricultural science. Chart No. 2 summarises the essence of the present structure. For the purposes of planning education we will deal with two categories—the "ingénieurs agronomes" (long course) and the "ingénieurs techniques" (short course).

28. The table below sets out the agricultural degrees and diplomas obtainable, the average length of the course (from the end of the observation phase) and the kinds of training given. It is of fundamental importance for drawing up development hypotheses.

SIMPLIFIED TABLE OF QUALIFICATIONS, TYPES AND LENGTH OF COURSES AND SUBSEQUENT CAREERS

QUALIFICATION	LENGTH OF COURSE	TYPE OF COURSE	SUBSEQUENT CAREER
1	2	3	4
"Ingénieur agronome"	10-11 years	Higher 'long' courses	Senior personnel with general responsibilities
"Ingénieur des Techniques"	9 years	Higher 'short' courses	Senior technologists
"Technicien Supérieur"	6 or 7 years	Secondary 'long' courses	Middle level personnel: Technologists (e.g. agricultural and food industries)
"Technicien Agricole Breveté"	5 years		Agricultural advisory work, farmers' organisations, laboratories, technico-commercial posts, etc.
"Agent Technique"	4 years	Secondary 'short' courses	Highly skilled worker
"Brevet d'enseignement agricole", "Brevet d'apprentissage agricole"	3 years		Skilled worker

1. Specialised training may be introduced at any level.
2. The length of training shown is a minimum one and is reckoned as from the end of the observation phase (chart No. 1).
3. The 'social advancement' programme in France is meant to provide training "anolagous" to that of the general educational system and to give access to identical career activities.
4. Farmers may be given training at any of the levels of this structure.

3. EDUCATIONAL GUIDANCE

29. Chart No. 1 shows that with the present structure of secondary education, children and their families may exercise choice of a school at the end of the elementary and observation phases, and choice of a career stream at the third year. If t_0 is taken to be the last year of primary education, it may be said that educational guidance plays a special role at $t_0 + 2$ or at $t_0 + 4$. In 1961/62, there were about 200 public educational and vocational guidance centres and about 775 "advisers".[1]

30. For the end of the third year there have recently been created *guidance councils* (on which the principal teachers, parents, and governing bodies of the various schools open to the children concerned are represented).

31. The purpose of educational and vocational guidance is to bring about, through advice, a better matching of the supply of 'graduates' to the national demand, with due regard to the preferences and ability of the young people concerned. It is a basic tool of educational planning for general economic and social development.

4. THE SCHOOL ENROLMENT RATIO AND EDUCATIONAL ATTAINMENT IN RURAL COMMUNITIES

32. The statistics available show the same trends in school enrolment rates as in other European countries: higher rates in towns than in the country (Table 1), a lower intake into general education from farming families than from other socio-occupational groups (Table 2), and a shorter period of general and vocational education in agriculture than in other sectors of the economy (Table 3). Many factors help to explain this situation, such as the lack of educational facilities in country districts, the absence in some areas of a school bus service, relative income levels, the terms on which scholarships are granted, the effect of the social background, etc.[2]

TABLE 1. ENROLMENT RATIOS[1] THE FIRST FORMS OF SECONDARY SCHOOLS: 1963

Percentage.

PLACE OF RESIDENCE	C.E.G.[2]	LYCÉES	TOTAL
Rural areas	28	14	42
Towns of less than 10,000 population	39	18	57
Towns of more than 10,000 population (excluding Paris)	21	45	66
Paris	39	33	72
Average	28	27	55

1. Proportion of children resident in the location shown who were aged 11 and admitted in 1963 to C.E.G.'s and Lycées respectively.
2. C.E.G. = Collège d'enseignement général.
Source: French Ministry of Education statistics.

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[1] *L'organisation scolaire et professionnelle en France*, I.N.P., Paris (1962).

[2] *Ability and Educational Opportunity* (OECD, 1962).

TABLE 2. DISTRIBUTION OF SCHOOL, UNIVERSITY AND ACTIVE POPULATIONS BY SOCIO-ECONOMIC GROUPS: 1963

Percentage.

POPULATION		PARENTS' SOCIO-ECONOMIC GROUP[1]								
		FARMERS	HIRED FARM WORKERS	DOMESTIC SERVANTS	INDUSTRIAL WORKERS	SUPERVISORY PERSONNEL AND CLERKS	PROFESSIONS AND EXECUTIVES	INDUSTRIAL OR COMMERCIAL EMPLOYERS	MISCELLANEOUS	TOTAL
First form	Lycées	6.1	1.4	1.2	20.3	32.9	14.9	15.2	8.0	100
	CEG[2]	10.3	2.8	1.7	38.3	25.5	2.1	13.5	5.8	100
	Private secondary schools	14.8	1.0	0.8	9.6	23.2	20.2	24.2	5.9	100
	Private further educational establishments	20.0	1.4	1.8	23.9	23.8	4.7	20.9	5.5	100
Terminal classes	Lycées	6.5	0.7	0.9	9.7	31.1	22.3	18.6	10.2	100
	Private schools	13.4	1.5	0.6	4.9	13.1	30.0	25.3	7.2	100
Universities (State)		5.7	0.5	0.8	5.5	27.2	29.4	18.2	12.6	100
Total active population		15.9	4.4	5.4	36.4	20.3	4.0	10.5	3.1	100

[1] In the case of the total active population, the figures relate to the socio-economic distribution of that population and not of its parents.

[2] Collège d'enseignement général.

Source: French Ministry of Education — Informations statistiques — No. 55 (January 1964).

TABLE 3. DISTRIBUTION OF THE TOTAL AGRICULTURAL LABOUR FORCE BY YEARS OF SCHOOLING

Percentage.

POPULATION	0-8 YEARS	9-12 YEARS	13 YEARS OR MORE
Total	76	19	5
Agriculturally active	93	6	...

Source: H.S. Parnes, *Forecasting Educational Needs for Economic and Social Development* (O.E.C.D 1962), page 108 (Tables).

33. The general agricultural census of 1955 provides some information on the training received by *farmers*. Table 4 shows that in 1955 the rate of training was extremely low, with only 3.3 per cent of farmers having had any formal training. The rate is relatively higher for the younger generation, 16.5 per cent of farmers under 26 having received agricultural training, but it should be noted that in some cases this was only at the basic level, as is shown by the Table 6. Table 5 shows that the rate of training increases with the size of the farm labour force (i.e. the number of hired workers employed). The level of training is thus related to farm structure.

TABLE 4. AGRICULTURAL EDUCATION OF FARMERS BY AGE GROUPS: 1955

AGE GROUP	PERCENTAGE OF FARMERS WITH AGRICULTURAL TRAINING
25 and under	16.5
26 to 35 years of age	9.2
36 to 45 years of age	4.4
46 to 55 years of age	2.4
56 to 65 years of age	1.9
66 to 75 years of age	1.4
76 and over	1.2
Others not specified	9.5
All farmers	3.3

Source: French National Institute of Statistics (INSEE), *Recensement Général de l'Agriculture de 1955*, Tables pages 37 and 38.

TABLE 5. AGRICULTURAL EDUCATION OF FARMERS: TRAINING BY SIZE OF FARM LABOUR FORCE: 1955

NUMBER OF REGULAR HIRED WORKERS ON THE FARM	PERCENTAGE OF FARMERS WITH AGRICULTURAL TRAINING
None	2.4
1	6.1
2	9.6
3 or 4	13.3
5 to 9	20.4
10 to 19	29.9
20 or more	36.5
Not specified	2.8
All farmers	3.3

Source: French National Institute of Statistics (INSEE) *Recensement Général de l'Agriculture de 1955* Tables pages 37 and 38.

TABLE 6. AGRICULTURAL EDUCATION OF YOUNG FARMERS: 1955[1]

HIGHEST LEVEL REACHED	FARMERS
Graduates ("agronomes")	0.5
Agricultural Schools	3.9
Basic training ("premier degré")[1]	9.4
More than one type of training	0.6
Others not specified	2.1
Total	16.5
Received no agricultural training	83.5
Total	100.0

1. Farm operators aged 25 and under: training of variable length but generally short e.g. seasonal courses.
Source: Agricultural Census 1955.

34. Since 1955 some remarkable progress has been made, particularly in agricultural advisory work, and this trend has made farmers more receptive to technical progress and basic training. The statistics available do not at present warrant conclusions about the effect of this trend on the overall level of training, but in due course the growing importance of agricultural education over the last few years will be demonstrated.

5. AGRICULTURAL GRADUATES AND TECHNICIANS

35. Agricultural graduates and technicians may be classified under two major headings, according to the manner in which they are employed:

i) *Those who practice their profession on a farm:* farm holders or key personnel employed in a managerial capacity (managers or farm operators) or participating in farm management (foremen and supervisors, etc.); specialists 'working on their own account'. This is the category included in farm population censuses.

ii) *Those who do not practice their profession on a farm:* in government service (administration, research, teaching and advisory work, etc.); in farmers' organisations (such as co-operatives, finance societies, or agricultural credit corporations); in industries connected with farming (the food and agricultural industries) or, more generally, in any service or firm where the presence of an agricultural graduate or technician is thought desirable.

36. It is particularly difficult to count the numbers of agricultural graduates and technicians in this last category, unless one knows which employers to approach. An accurate picture of the situation could only be gained by taking a census of all graduates and technicians in all industries and services. This is particularly important because in areas dominated by smallholdings and family farms, nearly all agricultural graduates and technicians practice their profession off the farm. The large number of small low-income farms are not in a position to employ agricultural graduates and technicians, this being feasible only for large farms. This situation can be remedied in one of two ways: action by the authorities or by farmers' organisations.

37. The authorities have in fact set up schemes for fostering and disseminating progress (soil research, teaching, and advisory work), together with rural development and investment institutions, (e.g. rural works departments, a national agricultural credit co-operative, development companies, marketing boards, etc.). In addition, the farmers themselves have formed professional associations which use graduates and technicians. More recently, they have set up a number of 'promotional' bodies, whose main purpose is to make expert and technical knowledge available directly to the farmer, e.g. the Centre d'Etudes des Techniques Agricoles, farm management centres, advisory centres, breeding stations, etc.

38. Compared with other industries, agriculture thus has an unusual system of professional staffing, since the agricultural graduate or technician rarely works on a farm and is more often than not an 'official' rather than a salaried employee.

39. In 1962, the "Association pour l'emploi des cadres, ingénieurs et techniciens de l'agriculture" (APECITA), acting with the Productivity Service of the Commissariat du Plan, carried out an extensive survey which culminated in an estimate of needs for 1967.[1] Thirty thousand questionnaires were sent out and 7,000 employers replied (a list of the bodies and enterprises covered by the survey is given in Annex I). In some cases, enough replies were received to justify grossing-up for the whole sector concerned, and although the methods and the findings of the survey should be treated with some caution[2] it represents the fullest source of information available and the first attempt at constructing a 'development model'.

40. The main findings of the survey are set out in Table 7. The bodies taking part are classified under four headings, two of which are sub-divided. Under each heading, each category of personnel is further broken down by

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[1] *Étude sur le marché du travail des cadres de l'agriculture, des industries agricoles et du secteur para-agricole*, 1957, 1962 et 1967, APECITA, 11, rue de Clichy, Paris-9^{e}.

[2] Some of the more important theoretical and practical problems encountered by this survey are discussed in Appendix II.

TABLE 7. STRUCTURE OF THE LABOUR FORCE IN AGRICULTURE AND ASSOCIATED ACTIVITIES: 1962

Percentage.

CATEGORY	SUB-GROUP	NUMBER	QUALIFICATION[1]				AGE GROUP				
			(I)	(II)	(III)	(IV)	20-29	30-39	40-49	50-59	60-69
I. Employed on farms[2]		12,000	10.0	17.0		73.0	8.0	29.4	24.5	25.0	13.1
II. Government service and public bodies[3]		9,000	57.7	33.2		9.1	22.0	31.0	25.0	21.0	
III. Professional personnel not engaged in actual farming	1. ECONOMIC AND FINANCIAL ORGANISATIONS	At least 10,000[4]									
	a) Co-operatives		21.7	32.9	4.4	41.0	20.0	33.2	25.4	17.1	4.4
	b) Finance societies		12.1	17.3	8.1	62.5	3.3	32.6	40.6	20.8	2.7
	c) Agricultural credit bodies		16.0	15.8	7.8	60.4	9.2	42.0	25.6	18.5	4.7
	2. BODIES CONCERNED WITH PROMOTING PROGRESS AND FARM MANAGEMENT TECHNIQUES	At least 2,500[5]									
	a) Group 1[6]		52.8	27.7	9.5	10.0	38.4	42.9	13.2	3.7	1.8
	b) Group 2[7]		32.4	25.6	12.8	29.2	36.9	32.9	19.0	8.8	2.4
IV. Employed in industries connected with agriculture	Supplying industries[8]	At least 9,000	49.7	23.9	3.2	23.2	9.4	37.9	25.4	19.1	8.2
	Processing industries[9]		28.9	25.5	2.7	42.9	10.0	33.9	26.8	20.4	8.9

[1] I. Higher education
II. 'Long' secondary
III. 'Short' secondary
IV. Self-taught.

[2] Farm operators, managers (top-level personnel); foremen and supervisors (medium-level personnel).

[3] INRA—Education—Central Government—Other government services—Caisse Nationale de Crédit Agricole—ONIC— Development Companies—Crédit Foncier.

[4] This figure may be regarded as a minimum: the APECITA data cannot be grossed up.

[5] As for (4) above.

[6] SAFER; CETA; management centres; breeding stations.

[7] Chambers of Agriculture; national and regional farmers' organisations.

[8] Animal feedingstuffs, cold chain, fertilizers, farm machinery and implements, chemical and phytosanitary products.

[9] Agricultural and food industries.

Source: APECITA Survey.

level of qualification [higher education (I), 'long' secondary education (II), 'short' secondary education (III), self-taught (IV)] and by *age*.

41. This table shows the personnel structure for each of the different categories. It will be noted, for example, that for farms the amount of 'intellectual investment' is low (10 per cent of higher educated personnel, 73 per cent without formal training) and that the age level is high (only 37 per cent are under 40), whereas government services have a high rate of 'intellectual investment' (58 per cent of 'higher-educated' personnel) and the age level is low (53 per cent under 40). Other comments may be made on each category. There is a very high percentage of personnel without formal training in economic and financial organisations, even though they play a leading role in the economic and social development of agriculture.

6. THE STOCK OF STUDENTS AND OUTPUT OF AGRICULTURAL EDUCATION

42. There are no reliable data for classifying students into the categories used in Chart No. 1. This is chiefly due to the fact that agricultural education is going through a period of flux, with new and old forms co-existing until the latter have been suitably adapted and fitted into the the new structure. In Table 8, the student population is broken down into three 'levels' Private schools and colleges play an important part in training farm people at the first level, especially in the case of girls. These correspond very roughly to the categories used in Chart No. 1, as shown in Table 9.

TABLE 8. DISTRIBUTION OF THE NUMBERS ON ROLL IN PUBLIC AND PRIVATE AGRICULTURAL EDUCATIONAL ESTABLISHMENTS: 1962/63

CATEGORY[1]	PUBLIC EDUCATION		PRIVATE EDUCATION		TOTAL	
	No.	%	No.	%	No.	%
1st 'level'	8,100	11	65,600	89	73,700	100
2nd 'level'	4,622	70	2,000	30	6,622	100
3rd 'level' (higher education)	1,927	76	600	24	2,527	100
Total	14,649	18	68,200	82	82,849	100
Boys	9,950	26	28,350	74	38,300	100
Girls	4,699	10	39,850	90	44,549	100
Total	14,649	18	68,200	82	82,849	100

1. In view of the present state of transition in educational organisation, the old nomenclature is used here. For rough equivalences, see Table 9.

Source: Paysans—Tableau de l'agriculture française (1964).

TABLE 9. SUMMARY OF NUMBERS ON ROLL BY EDUCATIONAL TYPE

TYPE	No.	%
'Terminal' type vocational training and 'short' secondary education	73,700	89
'Long' Secondary education	6,622	8
Higher education	2,527	3
Total	82,849	100

43. The typical feature of recent years has been the rapid growth in the number of agricultural students. Compared with 1963, the number of boys attending State secondary schools rose by 30 per cent in 1964, and the number of girls by 24 per cent (Annex II contains the statistics for the last two years, which were issued recently by the Ministry of Agriculture). This increase is due to the entry into force of the Law of 2nd August, 1960, and to profound changes in the attitudes of the farming community as a result of economic and social trends. It is no exaggeration to say that agricultural education in France is taking on a completely new dimension. The State's increasing effort in favour of intellectual investment in agriculture can be seen from the table in Annex III, which shows the trend of government aid to agriculture. From 1961 to 1964, funds for research and education trebled and the share of the total represented by 'intellectual investment' rose from 2.5 per cent (pre-1959) to almost 5 per cent in 1964.

44. A recent survey of the social origin of students in technical colleges and schools run by the Ministry of Agriculture gave the following data:

TABLE 10. SOCIAL ORIGIN OF STUDENTS IN AGRICULTURAL EDUCATION

Percentage.

FAMILY BACKGROUND	MALE STUDENTS	FEMALE STUDENTS
'Farming' families	60.8	60.7
'Rural' families	11.2	19.4
Others	28.0	19.9
Total	100.0	100.0

Source: Bulletin d'Information of the French Ministry of Agriculture.

This table shows that most students come from farming families, and whilst other come from rural non-farming families there is a relatively high percentage of students from urban homes.

7. LINKS BETWEEN AGRICULTURAL EDUCATION AND OTHER FORMS OF 'INTELLECTUAL INVESTMENT'

45. The recent reform of the Ministry of Agriculture's external services included the creation of a corps of "Ingénieurs d'Agronomie", whose main functions are to keep farmers and their organisations informed of recent progress, to inspect, run, and teach in agricultural education and vocational training establishments, and to concern themselves with the social advancement ("promotion") of the farming community. The three tasks of *teaching*, *advice* and *social advancement* are thus now being co-ordinated. The Ecole Nationale Supérieure des Sciences Agronomiques Appliquées (ENSSAA) at Dijon will be responsible for the training of the "ingénieurs d'agronomie", of teachers for the agricultural lycées and of 'social advancement' experts, and will also be called upon to organise the teaching, research and studies needed to develop 'intellectual investment' in agriculture and to make it more effective.

III. DRAWING UP A PROGRAMME

1. DEFINITION OF AIMS AND PRINCIPLES

a) *General aims of agricultural education*

46. The survey of the present position made in Chapter II has shown the relatively low level of education in rural communities, the high percentage of self-taught persons and the high average age of farmers. Furthermore, agriculture is changing rapidly and a considerable amount of 'intellectual investment' is needed. The trend in Government spending and the growing number of teaching establishments and students all signify, however, that the last few years have seen agricultural education in France take a real step forward. Now it is appropriate to assess needs and to drawup a development programme for the years ahead. Educational planning must be seen in relation to the planning of research, advisory work and social advancement. This is particularly necessary in the case of France where education and training, and the dissemination of progress in all its forms, will in future be the responsibility of the "ingénieur d'agronomie".

47. The purpose of agricultural education is to train future farmers and farm workers, together with agricultural graduates and technicians employed either in farming or allied industries. It does not however exclude other forms of education, and farmers and key agricultural personnel may be trained either partially (by changing over from other studies) or totally (for certain special subjects) by other means. Evaluating the *aims* of agricultural education is not therefore the same as evaluating the *needs* of agriculture. But is it fair to argue that agricultural education will in fact cater for almost all the needs of the rural population provided it is adapted to those needs, and is suitably fitted into the general educational system (i.e. into streaming and channeling schemes, arrangements for switching from one course to another, equivalence and the same sequence of degrees and diplomas, etc.) and adopts appropriate teaching methods.

48. The process of change in rural life being both technical and sociological, agricultural teaching programmes are based on the biological and social sciences. Since the pace of rural change is tending to quicken, and agricultural employment is declining as a percentage of total employment, the fundamental aim of agricultural education—as with all education in a growing economy—must be to make people receptive and adaptable to change. Adaptability implies as much *general* education as possible (in order to facilitate the inevitable changes in courses of study and in occupations) and a *basic scientific* training, rather than a too specifically technical one based on a 'fund' of knowledge that may rapidly become out of date. More precisely, agricultural education must link the teaching of science with its applications, constantly bring out the relationship between science and technology, and make people more receptive to progress by arousing their scientific curiosity.

49. If agricultural education is to meet agriculture's needs it must match them both *quantitatively* and *qualitatively*. Education must be the subject of research and, in this respect, the setting up of an "Institut de recherches et d'applications pédagogiques" at the Ecole Nationale Supérieure des Sciences Agronomiques Appliquées, in Dijon, is of great interest.

50. The rest of this study will take *quantitative* planning as its main theme, but *qualitative* planning, which calls for the adaptation of methods and structures, will not be overlooked.

b) *Principles of quantitative planning*

51. "Most governments now accept formal responsibility for the level of economic activity. This implies that they have to take a view about the appropriate pressure of demand, i.e. the relationship between aggregate demand and aggregate supply in the economy. It also implies that they have to take whatever measures they think necessary—fiscal or monetary measures, direct controls, or perhaps merely persuasion—to achieve this relationship."[1]

52. Government responsibility is traditionally involved in the field of education. Access to education is recognised as a human right, school attendance is compulsory (up to a given age) and in principle free, and the educational system is financed mainly out of public funds. It is becoming ever more widely recognised that education is a basic instrument of economic growth.[2]

53. It follows then that Government must forecast the trend in the demand for skilled personnel and decide the action needed to influence that trend or to satisfy it. This type of forecast may be described by reference either to the period covered or to the method used. Coming back to the French approach, we find three kinds of forecasts in terms of the time range covered:

i) long-term projections (15-20 years);
ii) medium-term projections (for a five-year plan);
iii) short-term forecasts (covering a budget year).

54. For the preparation of the Fifth Plan (1965-1970) the French Prime Minister appointed, in 1962, a "*1985 Group*", "... to study, in the light of facts with a bearing on the future, what it would be useful to know now about the France of 1985 in order to provide guidance for the general lines of the Fifth Plan .... These projections of the future, which are intended to guide our decisions, are a compound of the probable and the desirable. The real aim is to pave the way for the latter rather than hazard a guess at the former, to foresee a desirable future which appears feasible and will become a probability for a society determined to achieve it".[3]

55. The methods used are linked to the time-range of the projection. The '1985 Model' is more a matter of 'forward-looking' thinking than of forecasting in the true sense, but the '1970 Model' is a different case. For the latter period, it is possible to construct models which are either 'desirable' or 'probable' (i.e. if certain conditions are met—the latter may be called conditional models).

56. A choice of aims which can probably be achieved if suitable means are employed constitutes a programme in the true sense. Drawing up a development programme for agricultural education means therefore deciding on ends and means. At the same time, so many factors are interdependent that such decisions can only be made within the framework of a general programme of

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[1] *Techniques of Economic Forecasting* (OECD, Paris, 1965), p. 9.

[2] *The Residual Factor and Economic Growth* (OECD, Paris, 1964).

[3] Commissariat Général du Plan, *Réflexions pour 1985—Travaux pour le Plan*, Paris (1964).

economic and social development, and more especially within the framework of the general educational programme which results therefrom.

57. In the context of economic growth, the problem of planning education as an 'investment' may be considered in terms of the comparative marginal productivities of physical or of 'intellectual' investment. Assuming that a country saves and invests 20 per cent of its gross national product in real capital, and invests a further 3 per cent in education, would it be appropriate (for example) to raise the overall rate of investment to 24 per cent (reducing consumption by 1 per cent) and to make additional investment in education or other sectors?[1] As far as we know at present, this kind of approach is scarcely practical. Furthermore, even if it were possible to make the preceding calculation accurately, our conclusions would only be elements to bear in mind because education is in reality both an investment and an item of consumption. "... education serves humanistic and democratic ends which are largely distinct from strictly economic needs...".[2]

58. Educational planners have turned their main attention to forecasting employment and the levels of educational skill in relation to the overall socio-economic trend. This is the approach which will be adopted in this study, where the following will be taken in turn:

i) forecasting the level of agricultural employment;
ii) estimating the desirable levels of attainment;
iii) assessing the numerical requirements by levels of skill.

The *targets* having been stated, the next step is to define the *means* to be employed (without which the targets cannot be attained), and to draw up the programme itself.

59. One last point of methodology should also be mentioned. For drawing up the programme, one can use either a mathematical model or proceed by 'successive approximations', the latter method being the one adopted for the present survey. This does not mean that construction of a mathematical model has been dismissed altogether; it requires however thorough research beforehand and it can only be used in practice if statistical material is collected which is at present not available.

2. FORECASTING AGRICULTURAL EMPLOYMENT

a) *The methods available*

60. Forecasting of agricultural employment may be done either from national estimates of the trend and pattern of employment or from a survey of agriculture alone. Only the first method however is really adequate. The trend of the agricultural population depends both on the demand for agricultural manpower and on the jobs offered to farmers and farm workers by *other sectors* (job creation). In the economic growth process in Europe, the agricultural population is *a residual population* (i.e. one that remains once the other sectors have claimed the manpower they need for their own growth).

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[1] *Targets for Education in Europe in 1970*, by Ingvar Svennilson and Associates (OECD, 1962), p. 47 et seq.

[2] Raymond Poignant in *The Planning of Education in Relation to Economic Growth*, (OECD., 1962), p. 19.

61. The basic parameters of employment (E) forecasting (whether overall or by sectors) are the trends between period *o* and period *t* in the *active population* ($T_0 \rightarrow T_t$), in *production* ($P_0 \rightarrow P_t$), in the *working year*, which may be expressed in hours ($H_0 \rightarrow H_t$), and in *the productivity of labour per manhour* ($W_0 \rightarrow W_t$). The trend of employment may then be written as follows:

$$E_0 = \frac{P_0}{W_0 \times H_0}$$

$$E_t = \frac{P_t}{W_t \times H_t}$$

$$\Delta E = \left(\frac{P_t}{W_t \times H_t}\right) - \left(\frac{P_0}{W_0 \times H_0}\right)$$

62. The trend of labour productivity in agriculture is, however, difficult to forecast, since it is not a completely independent variable: it may be either the cause and/or the effect of a decline in the agricultural labour force, which in turn depends on the creation of new jobs outside agriculture. To some extent the productivity of agricultural labour in the context of economic growth is itself a residual phenomenon.

63. Forecasting the probable active agricultural population is thus inseparable from forecasting the trend of *general* employment by sectors. Estimates may however be made of the *desirable* agricultural population by reference to certain labour standards (estimating the manpower needed for a particular pattern of production, e.g. the number of man-hours required per acre and per livestock unit at a given technological level), to farm structure (i.e. making assumptions about its evolution), or to incomes (the parity assumption).[1] Employment forecasting is a necessary prior condition for drawing up an educational growth model. If a forecast of agricultural employment has already been made in connection with overall forecasting or planning, this should of course be used.

b) *The method used*

64. France having adopted the principle of flexible planning, the planning authority draws up employment forecasts in the following four stages;

i) a *global* forecast to determine the total supply of manpower;
ii) a forecast by *economic sector*, in order to adjust employment to production targets;
iii) a forecast by *occupations* within each sector;
iv) a forecast by *geographical region.*

The forecast of agricultural employment is reconciled with the global forecast but is also guided by estimates based on standards of the type referred to in the previous paragraph.[2]

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[1] *Training Course on the Planning of Agricultural Education*, L. Malassis (OECD, 1964), pp. 41-53.

[2] J. Fourastie in *Employment Forecasting* (OECD, 1963).

c) *Forecasting trends in the French active agricultural population*

i) *Recent trends in the active population*

65. Table 11 gives the basic data for general and agricultural employment in 1962. The total active agricultural population represents 20 per cent of the total active population. The agricultural activity rate of women is about 50 per cent that of men. Total family labour represents 78 per cent of the total active agricultural population.

66. The Institut National de la Statistique et des Etudes Economiques (INSEE) has drawn up tables for the variation in the active agricultural population between 1954 and 1962 (Tables 12 and 13). In the course of that period, there was an annual decrease of 165,000 (3.6 per cent compound). The total size of the decreases for the period as a whole varied with occupational categories as follows:

Total active agricultural population	25.3 %
Active male agricultural population	22.1 %
Active female agricultural population	30.6 %
Employers and self-employed	12.6 %
Family workers	34.7 %
Hired workers	28.6 %

TABLE 11. GENERAL AND AGRICULTURAL EMPLOYMENT: 1962

CATEGORY	NUMBER (THOUSANDS)	PERCENTAGE
Total active population:		
Total active population	19,164.5	100
Total active agricultural population	3,841.2	20
Total agricultural active population by status:		
Employers and self-employed	1,673.4	43
Family workers	1,338.2	35
Hired workers	829.6	22
Total	3,841.2	100
Total agricultural active population by sex:		
Male	2,577.0	67
Female	1,264.2	33
Total	3,841.2	100
Male agricultural active population by status:		
Employers and self-employed	1,450.4	56
Family workers	394.3	15
Hired workers	732.3	29
Total	2,577.0	100

Source: INSEE.

ii) *Prospects*

67. The trend in the active agricultural population is directly determined by *occupational transfers* (young people leaving agriculture and changes of job in the

TABLE 12. VARIATION IN THE ACTIVE AGRICULTURAL POPULATION[1] BETWEEN 1954 AND 1962

CATEGORY	MAY 1954	MARCH 1962
Men	3,318,000	2,577,000
Women	1,820,000	1,264,000
Total	5,138,000	3,841,000
Decrease: Total	1,297,000 (25.3%)	
Per year	165,000 (3.6%)	

1. Excluding men doing military service.
Source: Perspectives d'évolution de la population de la France, Etude statistique No. 3 (INSEE, 1954), page 208

TABLE 13. MALE ACTIVE AGRICULTURAL POPULATION[1] BY AGE GROUPS

AGE REACHED IN THE COURSE OF THE YEAR	MAY 1954		MARCH 1962	
	NUMBER	%	NUMBER	%
Under 25	618,000	18,6	265,000	10.3
25 to 44	1,164,000	35.1	992,000	38.5
45 to 64	1,199,000	36.1	1,051,000	40.8
65 and over	337,000	10.2	269,000	10.4
Totals	3,318,000	100.0	2,577,000	100.0

1. Excluding men doing military service.
Source: Same as Table 12.

course of the working life), the *average working life* (age when first starting to work in relation to length of schooling and retirement age) and the *age pattern of the active population* (effects of an aging agricultural population). The main factor is occupational transfers, which depend on the creation of non-agricultural jobs and the 'response' of the agricultural labour force, having regard to the possible improvement of the productivity of agricultural labour (a function of technological progress and management) and to transfer incentives (differences in incomes and ways of life). As already pointed out, however, forecasts of the agricultural population must be made in the context of forecasts of the total national labour force and made consistent with an overall 'labour balance sheet'. A supply and employment analysis of this kind, as used in the French Plans, is show in Table 14.

68. In France, a number of schemes have been introduced to encourage the retirement of elderly farmers, occupational transfers and the development of 'viable' farms; a fund has been set up for social welfare purposes and for reorganising farm structure. These measures should help to make changes more acceptable and humane and should speed up (depending on the money made available) the decline in the size of the agricultural population. However, for the period of the Fifth Plan, and with due regard to the general economic trend and the net supply of non-agricultural jobs, the cost of occupational transfers,

TABLE 14. SUPPLY AND UTILISATION OF MANPOWER 1965-1970

Thousands.

YEAR	POTENTIAL LABOUR SUPPLY		ADJUSTMENT FOR ACTIVITY	ANNUAL AVERAGE ACTIVE POPULATION	ANNUAL AVERAGE DISTRIBUTION OF ACTIVE POPULATION							
					ARMED FORCES		UNEMPLOYMENT	EMPLOYMENT IN FRANCE				
	31st DECEMBER	ANNUAL AVERAGE			REGULAR SERVICE OVERSEAS	NATIONAL SERVICE		AGRICULTURE	INDUSTRY	SERVICES	OTHER	TOTAL
1965[1]	(20,740)	20,550	−400	20,150	45	290	325	3,415	7,660	5,395	3,020	19,490
Variation 1965 to 1970	Natural increase at constante activity rate ..... +890 Net immigration .... +325 Raising overall school enrolment ratio .... −530 Reduction of activity rate for older age-groups .... −225 Raising activity rate for women .... +100 Net variation .... +560	..	..	+610	−20	−45	+25	−585	+350	+595	+290	+650
1970	21,300	21,020	−260	20,760	25	245	350	2,830	8,010	5,990	3,310	20,140

.. Not avaible.

1. Provisional estimate available at the time of the 'Economie Budget' of May 1965.

Source: Commissariat Général du Plan, "*Overall Balance of Employment*", page 10.

etc., a reduction of about 115,000 in the active agricultural labour force per year was finally adopted as a working hypothesis, which would leave a total active population of 2,830,000 in 1970[1]. Assuming that the female activity rate will remain unchanged, the male active agricultural population in 1970 will be about 1,900,000.

69. The forecasts for 1985 are tentative, being a combination of the desirable and the probable. With due regard to the increasing rate of technical progress in agriculture, the active agricultural population will depend chiefly on the trend of the overall economy. The "1985 Group" estimates that "... between now and 1985, French agricultural production will have doubled..., and the active agricultural population will have declined by a half".[2] This forecast assumes an increase in the gross productivity of agricultural labour of about 400 per cent, which means that considerable progress will have to be made in technology and management—which in turn will call for considerable efforts in the field of education and training. By 1985, it is thought that the active agricultural population will be between 1,500,000 and 2,000,000, or between 6 and 9 per cent of the total active population. For our 1980 hypothesis an order of magnitude of 1,500,000 male workers (including farmers) will be adopted.

70. Despite the uncertainty attaching to the prospects for 1980, it is worth taking a long view when constructing an educational development model. The children born in 1965-1970 will be between 10 and 15 years of age in 1980, so that they will be either finishing the elementary course or going through the 'guidance' phase. Provision for their education will have to be made sufficiently well in advance. However, this long-term forecasting will need to be constantly revised in the light of medium-term forecasts (5 years ahead) as well as short-term ones (for the current financial year). In the following pages, we shall pay particular attendion to the 1970 and 1980 hypotheses.

3. THE ANNUAL NUMBER OF FARMERS AND FARM WORKERS TO BE TRAINED

71. In the first instance, only the annual number of young males will be considered under this heading. Some specific problems arise in connection with the training of women which will be discussed later. To estimate the annual number of farmers and farm workers to be trained, one can calculate the average proportion of the agricultural population to be replaced each year, having regard to the average length of the working life. Assuming the average working life to be 40 years (from 15-20 years to 55-60 years of age), and given our estimate of 1,900,000 for the male active agricultural population in 1970, the annual quota is of the order of :

$$\frac{1,900,000}{40}=47.500$$[3]

The following table illustrates the trend in the male annual 'training quota':

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[1] Act No. 64-1265 of 22nd December, 1964, approving a report on the main policy decisions connected with the preparation of the Fifth Plan. (*Journal Officiel* of 23rd December, 1964).

[2] Commissariat Général du Plan, *Réflexions pour 1985*, p. 130.

[3] The principle of taking one-fortieth is discussed further elsewhere in this Report. In the case of a declining labour force, this estimation method over-states the true number.

Table 15. ANNUAL NUMBER OF MALES TO BE TRAINED

YEAR	MALE ACTIVE AGRICULTURAL POPULATION	TRAINING QUOTA
1970	1,900,000	47,500
1975	1,750,000	43,750
1980	1,500,000	37,500

4. TRANSFORMATION OF MANPOWER TARGETS INTO TRAINING NEEDS

a) *Levels of attainment*

72. Several factors influence the levels of attainment which are desirable—the socio-occupational pattern of the active agricultural population, organisational trends in farming and labour productivity, the average national rate of training (the parity assumption), the rate of agricultural training in competing countries (international competitiveness) and so on. All these factors exert an influence tending to improve the levels and rates of training. The historical 'law of a diminishing agricultural population' implies that the annual number of trainees will also diminish, but this should not be taken to mean that the agricultural training effort will ease off. Quite the contrary is true, since the rate and level of training of the agricultural population are both rising.

73. The French active agricultural population is predominently made up of family labour: 78 per cent of the total consists of farmers and their families, and only 22 per cent of hired workers. Family workers are fewer in numbers than farm operators (see Table 11) so that, with the present farm structure, many of them will become farmers at some time in their working lives. Their basic training should therefore be designed to fit them for the task of management. ('management preparation' courses might also be introduced at a later stage).

74. Hired workers number roughly 830,000. They have no management responsibilities, either on farms or in farmers' organisations. One of the aims of agricultural education must thus be to train skilled workers.

75. However, the *level* of training must not be determined by whether those concerned are "hired workers' sons" or "farmers' sons". Democratisation presupposes that the level must be related to the *aptitude* and *ability* of each trainee. The hired worker's son may well turn out to be excellent material for higher agricultural education. If a boy cannot pass the "Brevet d'apprentissage" stage, he cannot aspire in the immediate future to be more than a skilled worker; but at a later stage, advancement schemes may offer him a wider choice. Agricultural training should therefore offer a basic education "analogous" to that of other social and occupational categories, the level of training and specialisation depending both on the aptitudes of pupils and on the agricultural needs. These needs change with the evolution of farm structure.

76. The '1985 Group' estimates that "In 1985, the bulk of production will be supplied, processed and sold by a small number of integrated units".[1] A characteristic of these integrated units will be the highly specialised division

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[1] *Réflexions pour 1985*, page 133.

of labour between them. The forms that the 'industrialisation' of agriculture takes are another important consideration. The 'co-operative' form, for example, based on the principle of economic partnership, implies that farmers have had a very good basic training. Moreover, the prospect of the productivity of agricultural labour quadrupling between 1960 and 1985, at an annual average rate of increase of 5.7 per cent (compared with 4.2 per cent in industry),[1] implies that agricultural work will become more and more skilled. To sum up, the economic trend is leading towards higher levels of training, specialisation of teachers at all stages, and a rising technical/other 'staff ratio' in agriculture.

77. The social trend is pointing in the same direction. In the 'advanced' countries, and particularly in France, farmers are complaining about the various forms of unequal treatment to which they are subjected—not the least of them being the comparative lack of educational opportunity. Towards 1970, about 42 per cent of the French population aged 17 will be attending school, and by 1985 almost 100 per cent.[2] If a vigorous effort is not made in the years ahead to improve the situation of rural communities in this respect, their educational lag will become greater. It is clear that the development of education must be carried forward at the same time as rural development as a whole. 'Modernisation of the farm' and 'modernisation of the farmer' are linked otgether.

b) *Number of farmers and farm workers by levels of training—A choice of assumptions*

78. Three levels of skill will be considered, as follows:

i) vocational training;
ii) the short course of secondary education (agricultural "Collège");
iii) the long course of secondary education (agricultural "Lycée").

Although it is true that future farmers and farm workers will have access to education at all levels, it can be assumed that only a small number of them will go on to higher education in the next few years.

79. In view of the present relatively low levels of training, the need to develop agricultural education in relation to the modernisation of agriculture, the efforts made by the Ministry of Agriculture in recent years, the general spread of education, etc., a possible first step is to propose 'reasonable' rates in the light of the preceding analysis of the situation.[1]

80. These 'reasonable' rates will serve as a basis for calculation of the resources that would be needed and will enable their budgetary implications to be assessed. In the final analysis, the authorities are responsible for deciding, in the general context of the social and economic development plan, the budgetary appropriations which are desirable, but calculations of this kind may help them to choose between alternatives and to reach decisions.

81. Table 16 shows that, despite the decline in the annual training quota—which is bound up with the fall in the active agricultural population—numbers taking the long and short courses of secondary education would increase in relation to the rise in rates of training. Eventually, the distribution of students among the various courses of education would depend essentially on the ability

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[1] *Réflexions pour 1985*, page 139.
[2] *Réflexions pour 1985*, page 39.

of the candidates. It would thus be important to analyse the intellectual resources available and to adapt teaching methods accordingly.

TABLE 16. DISTRIBUTION OF TRAINING QUOTA BY LEVELS OF TRAINING[1]

YEAR	TRAINING QUOTA	DISTRIBUTION BY TYPE OF TRAINING[2]					
		LONG SECONDARY		SHORT SECONDARY		VOCATIONAL TRAINING	
		%	NUMBER	%	NUMBER	%	NUMBER
1970	47,500	15	7,125	30	14,250	55	26,125
1975	43,750	25	10,938	40	17,500	35	15,312
1980	37,500	35	13,125	50	18,750	15	5,625

1. Males only.
2. Excluding higher education

c) *Numbers of agricultural graduates and technicians*

82. A 'reasonable' estimate of the number of agricultural graduates and technicians needed is more difficult to make than is the case with farmers and farm workers, for these graduates and technicians are not employed exclusively by the agricultural sector, nor are they the only kind of specialised personnel the agricultural sector uses. Furthermore, statistics are notoriously inadequate and methods of forecasting have been little studied. The necessity should be stressed of developing methodological research and of improving statistics, so that a long- and medium-term policy for technical agricultural training can be drawn up at all levels[2].

83. The following suggestions are made for improving the statistics at present available:

i) An overall census of graduates and technicians by 'training groups' and by sectors (and by 'training groups' within a sector), as well as by age-groups and by functions.

ii) A census carried out by 'Associations of Former Students' (when they are sufficiently representative), for the purposes of a breakdown by branches of activity, ages and functions.

84. The techniques of forecasting which come to mind are the following:[3]

i) *Survey of employers' requirements:*
Net probable demand = New jobs + Replacements — Redundant jobs.

ii) *Relationship between general, economic and agricultural growth, and the number of agricultural graduates and technicians* (e.g., the relationship between the net productivity of labour in agriculture and the ratio of technical to other personnel).

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[1] Several alternative hypotheses could be considered for the distribution between levels of training. Since the purpose of the present study is to investigate and illustrate *methods* of estimation, only one hypothesis has been adopted.

[2] See Appendix I at end of the Report.

[3] *Economics of Higher Education* (United States Department of Health, Education and Welfare, Office of Education, Washington, 1962), p. 62.

iii) *International comparisons:*
Comparison of the ratio of technical to other personnel (number of graduates and technicians per 1,000 labour force) in countries at different levels of economic development (GNP per head) and of rural development (income per head in agriculture). Use of this method implies the prior availability of comparable statistics.

iv) *Development of 'technical personnel' models with due regard to changing farm structure and methods of production:* Such models would lead to estimates of 'desirable' training.

These are merely suggestions which, to be adopted, would call for suitable research and the collection of data which are at present lacking.

85. Effective use of technicians depends on whether they are employed in a suitable capacity, which in turn depends largely on their training. An effort is needed therefore to determine the desirable ratio of graduates to technicians at various levels. An unsatisfactory ratio can mean only that graduates are doing technicians' jobs or that technicians are being asked to carry out as best they can duties which are beyond their capacity. The norms derived from present statistics are not satisfactory, especially as concerns agriculture where until recent years a 'functional' ratio has not always been given consideration. A ratio of 1 graduate to 2 technicians has sometimes been suggested. It may be adopted as a working hypothesis until such time as further study of the subject has been made.

86. The APECITA survey (Annex I) had the special object of compiling forecasts of the demand for graduates and technicians by a 'market research' approach 'Probable net requirements' (New jobs + Replacements—Redundant jobs) were worked out for the period from 1962 to 1967. Chart No. 3 summarises these forecasts by types of training. It may be assumed as an order of magnitude that the net demand for agricultural graduates (excluding veterinary surgeons) will be 6,000, including about 5,000 "agronomes" and "ingénieurs techniques" making an average annual inflow of about 1,000. The net demand for agricultural technicians should be about 10,000, with a markedly higher proportion of technicians trained by 'long' courses than by 'short' ones, making an average annual inflow of some 2,000. This gives us a ratio of graduates to technicians of 1/2.

87. Study of the demand for graduates and technicians based on enquiries among employers often seems to produce results which are on the low side. In addition, the APECITA survey took place at a time when agricultural education was being reorganised, when different categories of technicians were less clearly defined than at present and when there was little training of technical experts. Furthermore, the percentage of replies from some parts of the field investigated was so low that the results could not be grossed-up. These forecasts can therefore be regarded as a minimum hypothesis, and a 'reasonable' hypothesis would be an output in 1970 of between 1,000 and 1,500 "agronomes" and "ingénieurs techniques" and of 3,000 technicians (2,000 of them trained by 'long' courses)—again, considering males only.[1]

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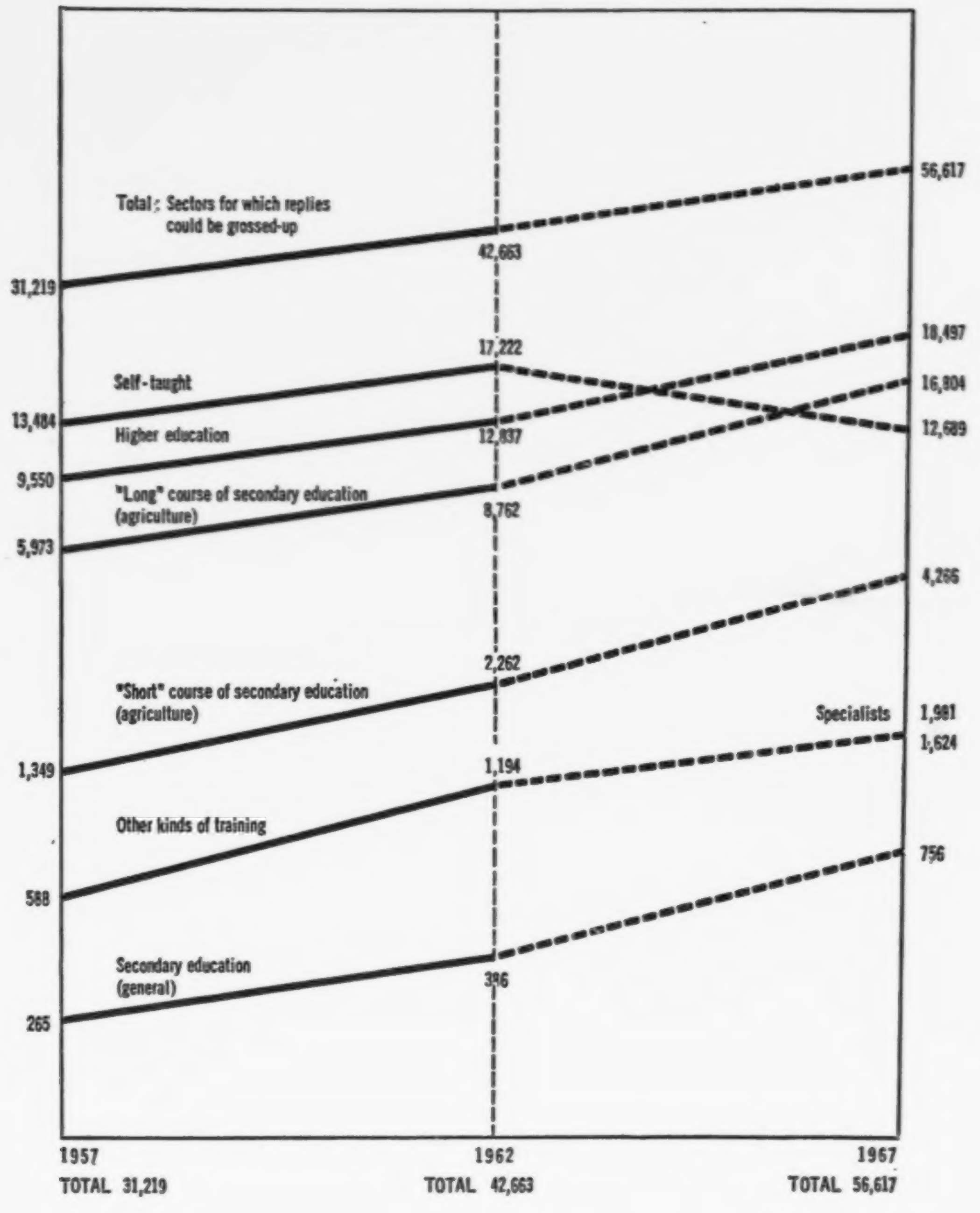
[1] The French Ministry of Agriculture estimates that requirements of 'agronomes' and 'ingénieurs' in 1970 will be 1,500 and 3,500 senior technicians. (*Bulletin d'Information du Ministère de l'agriculture* No. 226 of 3rd April, 1965).

Chart 3. QUALIFIED PERSONNEL IN AGRICULTURE, THE FOOD AND AGRICULTURE INDUSTRIES, AND ALLIED SECTORS: TREND BY TYPES OF TRAINING FROM 1957 TO 1967



Source: APECITA Survey—Annex I.

d) *The aims of agricultural education for males*

88. We have now established a 'reasonable' hypothesis for the number of farmers and farmworkers to be trained by 1970 and 1980, and have used a market survey to estimate the numbers of graduates and technicians needed in the next few years. In the present state of our knowledge and methods, it would not be 'reasonable' to make a forecast of the number of graduates and technicians for 1980.[1] Accordingly, this study will be confined to the 1970 targets and will be concerned more particularly with the 'long' and 'short' courses of secondary education.

TABLE 17. AGRICULTURAL SECONDARY EDUCATION TARGETS FOR 1970

OCCUPATIONAL CATEGORY	'LONG' SECONDARY EDUCATION (AGRICULTURAL LYCEES)	'SHORT' SECONDARY EDUCATION (AGRICULTURAL COLLEGES)
Farmers and farm workers[1]	7,125	14,250
Technicians[2]	2,000	1,000
Total	9,125	15,250

1. Table 16.
2. Paragraph 87.

IV. PRACTICAL IMPLICATIONS OF THE DEVELOPMENT HYPOTHESIS

89. In Chapter III, we established a 'reasonable' development hypothesis. Other hypotheses could be made by reference to the weight the authorities decide to give to agricultural education in the context of their overall economic and social development policy. But whatever hypothesis is adopted, it must clearly be a practical one. As an illustration, we will now calculate the resources needed to realise the 'reasonable' hypothesis. The basic data needed for a satisfactory calculation are sometimes lacking, so that the following project is only indicative. We will calculate in turn the 1970 targets for male agricultural secondary education (i.e. for Agricultural *Lycées* and *Collèges*), and we shall give some indication regarding the general hypothesis for education, vocational training and social advancement.

1. MALE AGRICULTURAL SECONDARY EDUCATION

a) *Targets, numbers on roll and resources*

90. The targets already stated determine the required output of the agricultural education system. It is assumed that students, on completing their course, will in fact move into the available jobs or that some kind of clearing scheme

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[1] "... With present knowledge, however, it is hardly possible to form a sufficiently clear idea of the quantitative and qualitative trend in demand for anything beyond the medium term".—*Forecasting Manpower Needs for the Age of Science* (OECD, 1960), p. 67.

will operate, since agricultural education is also suitable for posts outside agriculture. On the other hand, some students will repeat a year and others will

TABLE 18. ANNUAL TARGETS AND NUMBERS ON ROLL IN "LYCÉES" AND "COLLÈGES" FOR 1970

OUTPUT AND NUMBERS ON ROLL	COLLÈGES	LYCÉES
TARGETS:		
No. of "graduates"		
"Technicien supérieur" level	1	1
"Technicien breveté" level	—	9,000[2]
"Agent technique" level	7,500[3]	—
"Brevet" level	7,500	
NUMBERS ON ROLL[4]		
17 to 18 age (Terminal form)	—	9,473
16 to 17 age (6th form)	7,894	9,971
15 to 16 age (5th form)	16,204	10,495
14 to 15 age (4th form)	17,057	11,047
13 to 14 age (3rd form)	17,954	11,628
Total	59,109	52,614

1. No assumptions have been made about the "technicien supérieur" level.
2. Rounded figure.
3. It is assumed that 7,500 students will stay on to the "agent technique" level and 7,500 for the "brevet" level (Parts I and II). This rough breakdown of the total in Table 17 should be taken as provisional.
4. Allowing 5% annual wastage.

TABLE 19. NUMBERS ON ROLL, NUMBERS OF SCHOOLS AND NUMBERS OF STAFF

PARAMETER	COLLÈGES			LYCÉES		
Number on roll[1]	59,109			52,614		
Total number of classes[2]	1,688			1,503		
Number of schools[3]	241			150[4]		
TEACHING STAFF	PER SCHOOL[5]	PER CLASS[6]	TOTAL[7]	PER SCHOOL[5]	PER CLASS[6]	TOTAL[7]
Teachers	10	1.43	2,410	17	1.7	2,550
P.T. instructors	1	0.14	241	1	0,1	150
'Culture' teachers	1	0.14	241	1	0.1	150
Assistant technical teachers	7	1.00	1,687	9	0.9	1,350
Instructors	6	0.85	1,446	8	0.8	1,200
Total			6,025			5,400

1. From Table 18.
2. Total strength divided by 35. The teaching *norm* seems to be 30, whereas the *actual* size of classes is at present about 40.
3. "Collèges" with seven forms and "Lycées" with ten forms.
4. On the basis of "lycées" with 15 forms, the number of these would be 100.
5. On the basis of Ministry of Agriculture norms (Tables 21 and 22).
6. See note 3.
7. Norm per school × Number of schools or
Norm per class × Number of classes.

change their course or abandon their studies altogether. This means we must allow for a wastage rate whose extent is not at present known. Arbitrarily it has been fixed at the rate of 5 per cent per year. Bearing these uncertainties in mind, Tables 18 to 20 have been prepared as rough guides.

b) *Guidelines for the calculation of operating costs*

91. In the present transitional period no information exists about operating costs under the new system. Furthermore, it is clear that these costs will vary with the size of each establishment. Table 19 shows that when a "collège" which has seven forms is compared with a "lycée" which has ten, the increase in staff is less than proportional: this is doubtless also true of other items of expenditure.

TABLE 20. PERSONNEL AND STAFF TRAINING

STAFF	COLLÈGES		LYCÉES	
	PER SCHOOL	TOTAL	PER SCHOOL	TOTAL
STAFF SPECIFICALLY RELATED TO EACH SCHOOL[1]				
Principals	1	241	1	150
Assistant principals	1	241	1	150
Bursar	1	241	1	150
Secretaries	2	482	3	450
Contractual staff (services)	11	2,651	15	2,250
Total	...	3,856	...	3,150
TOTAL STAFF ESTABLISHMENT				
Teaching	6,025		5,400	
Other	3,856		3,150	
Total	9,881		8,550	
STAFF TO BE TRAINED FROM WITHIN THE AGRICULTURAL EDUCATION SYSTEM				
Principals	1	241	1	150
Assistant principals	1	241	1	150
Teachers	5	1,205	7[2]	1,050
Assistant teachers (farming)	5	1,205	6	900
'Culture' teachers	1	241	1	150
Total	...	3,133	...	2,400

1. See Tables 21 and 22.
2. For the breakdown between general and agricultural teachers see Table 22.

92. Estimates made in 1960 show that wages and salaries of personnel employed in all kinds of teaching establishment represented about two-thirds of the total operating cost (administration, teaching, general services and food). This gives us a guideline for an overall estimate.[1]

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[1] Based on a sample enquiry carried out in 1960 by the General Directorate for Agricultural Training.

TABLE 21. MALE AGRICULTURAL "COLLÈGES" (7-FORM TYPE) STAFFING SCALE

DUTIES	SPECIFICATION	OCCUPATIONAL GRADING	NUMBER
DIRECTION	Principal	"Ingénieur principal des services agricoles"	1
	Assistant principal	"Ingénieur des services agricoles"	1
ADMINISTRATION	Bursar	"Secrétaire d'intendance"	1
	Secretaries	"Dames secrétaires"	2
TEACHING	Teachers of: French, History, and Geography	"Professeur d'enseignement général de collège"	2
	Languages		1
	Mathematics		2
	Physics and Chemistry	"Ingénieurs des travaux agricoles" and "professeurs d'enseignement technique agricole"	1
	Nat. Sciences, Economics and Social Sciences		4
	Practical farming;	"Professeurs techniques adjoints d'exploitation de collège agricole"	5
	Handicrafts	"Professeurs techniques adjoints d'atelier de collège agricoles"	2
EDUCATION	Physical Training	P.T. Instructors	1
	"Cultural" Education	"Professeur d'education culturelle"	1
	General education and supervision	"Educateurs"	6
GENERAL SERVICES	Cooks	Auxiliary personnel	1
	Assistant cooks		2
	Maintenance staff		8
		Total	41

Source: Ministry of Agriculture.

c) *Guidelines for investment*

i) *Investment in human resources* (Agricultural "lycées" and "collèges").

93. Given the time needed for training, one of the factors likely to retard the progress of agricultural education is the shortage of teachers. Table 24 below shows the available supply in 1963 and requirements for 1970. Only teaching personnel to be trained by the agricultural education system are included.

94. The effort needed is therefore considerable. To the extent that a justified priority is given to agricultural "lycées", the number of teachers to be trained in the years ahead would be in the region of 1,200[1]. If "lycées" with only three terminal forms (i.e. 'three-form entry') were introduced, this would call for relatively fewer teachers.

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[1] From Table 20: 1,050 Teachers + 150 "Culture teachers".

TABLE 22. AGRICULTURAL "LYCÉES" (10-FORM TYPE) STAFFING SCALE

DUTIES	SPECIFICATION	OCCUPATIONAL GRADING	NUMBER
DIRECTION	Principal	"Ingénieur principal des services agricoles"	1
	Assistant principal	"Ingénieur des services agricoles"	1
ADMINISTRATION.......	Bursar	"Secrétaire d'Intendance"	1
	Secretaries	"Dames secrétaires"	3
TEACHING	Teachers of:	Professeurs agrégés ou certifiés de l'enseignement secondaire ou de l'enseignement agricole	
	French, History		2
	and Geography		1
	Languages		3
	Mathematics		2
	Physics and Chem.	Ingénieurs des Services Agricoles ou ingénieurs spécialisés des travaux agricoles	2
	Nat. Sciences, Economics and Social Sciences		7
	Practical farming	"Professeurs techniques adjoints d'exploitation de collège agricole"	6
	Handicrafts	"Professeurs techniques adjoints d'atelier de collège agricoles»	3
EDUCATION	Physical Training	P.T. Instructors	1
	"Cultural" Education	"Professeur d'education culturelle"	1
	General education and supervision	"Educateurs"	8
GENERAL SERVICES	Cooks	Auxiliary personnel	1
	Assistant cooks		4
	Maintenance staff		10
		Total	57

Source: Ministry of Agriculture.

ii) *Physical investment* (Agricultural "lycées" and "collèges").

95. In 1964 there were 38 lycées and 18 collèges for male students[1]. No information is available as to the real capacity of these establishments. In addition, there are three schools run by the dairy industry and three other specialised centres or schools (forestry, basketry and animal husbandry). The priority given to the agricultural "lycées" appears wholly justified, given the trend of the short course of secondary education and the declared preference (shared by farmers) for a basic education emphasizing general subjects.

96. The Ministry of Agriculture plan provides for one "lycée" (in principle, comprising 10 forms) in each département, or 90 in all. Our working hypotheses lead us to foresee a more ambitious programme than this. On the premises we have adopted, the number of agricultural "lycées" needed would be of the order of 150 with two-form entry or 100 with three-form entry (excluding the training of senior technicians).

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[1] BIMA, No. 199, 19th September, 1964, V Bl.

TABLE 23. CURRICULA

	PART I			PART II			PART III				
	4	3	2	4	3	2	4	3	2	1	T.A
NATURAL SCIENCES											
Animal biology	2	2	2	2	2	2	2	1	2	2	1
Plant biology	2	2	1	2	2		1	1	2	3	1
Agricultural sciences:											
— crop husbandry	—	—	2	—	—	3	—	—	3	2	2
— animal husbandry	—	—		—	—		—	—	1	2	2
Regional variations	—	—	5	—	—	3	—	—	—	—	3
Weekly reports	1	1	1	1	1	1	1	1	1	1	1
PHYSICS, CHEMISTRY, SOIL SCIENCE											
Physics	2	1	—	—	2	2	1	2	1	2	2
Chemistry	2	1	—	2	1	1	1	1	2	1	1
Study of soils	1	3	—	1	2	—	1	1	—	—	—
ECONOMICS AND SOCIAL SCIENCES	—	2	4	—	2	4	—	—	2	3	4
HISTORY AND GEOGRAPHY	2	2	2	2	2	2	2	2	2	2	2
FRENCH	4	4	4	4	4	4	4	4	4	3	3
FOREIGN LANGUAGES	—	—	—	4	4	2	4	4	3	3	2
MATHEMATICS	3	4	4	6	4	3	6	6	4	3	4
DRAUGHTSMANSHIP	—	—	—	1	1	—	—	—	1	1	—
	19	22	25	25	27	27	23	23	28	28	28
CONTROLLED APPLICATIONS AND OBSERVATIONS	4	4	8	4	4	8	4	4	4	4	4
MANUAL SKILLS	4	4	2	4	4	2	4	4	2	—	—
CULTURAL EDUCATION	2	2	1	2	2	1	2	2	1	1	1
PHYSICAL EDUCATION	4	4	4	4	4	4	4	4	4	4	4
	33	36	40	39	41	42	37	37	39	37	37

TABLE 24. STAFF TRAINING TARGETS 1963-1970

CATEGORY	1963[1]	1970[2]	DIFFERENCE
Principals	70	391	321
Teachers	134	3,037[3]	2,903

1. Statistique agricole (French Ministry of Agriculture), 1962, p. 11.
2. Table 20.
3. Table 20. Assistant principals + Teachers + "Culture" teachers.

d) *Guidelines for the school map*

97. The location of agricultural teaching establishments, particularly the lycées, raises many problems. It would seem desirable to aim at a greater concentration in areas where the density of the agricultural population is greatest. For although the agricultural population of these areas will probably decline, the agricultural lycées will be able to train qualified personnel for work in other areas and thus help to reduce the size of the agricultural population in overpopulated areas.

2. TENTATIVE ESTIMATE OF TRAINING REQUIREMENTS FOR MEN AND WOMEN

98. The estimate in the previous section related to exclusively *male agricultural secondary education.* It now remains to consider the problems raised by the agricultural education of girls and women, by vocational training and by social advancement.

a) *Estimation of training needs for women*

99. Estimating the trend of agricultural training for women and girls raises some difficult problems. The principle of equal education for men and women implies that all forms of agricultural training establishment should be open to women. At the same time, such training must clearly be related to the evolution of the family, occupational and social role of women in rural communities.

100. In principle, women should be able to get training which is analogous or identical to that given to men in technical "collèges" or "lycées"—either on a 'twinned' establishment or on a co-educational basis— but it is only reasonable to recognise that specialised training should be introduced at a certain stage.

101. A woman who will continue to work on a farm would probably prefer to receive an 'agricultural-type' education. As the activity rate of women is about 50 per cent of that for men, this fact and the application of the principle of equal education suggest as a 'minimum' hypothesis that the agricultural 'training rate' of young girls should, at the various levels, equal about 50 per cent of that of young men. By and large, this rate was confirmed by actual observation for 1964/65 (Annex II), but it should be remembered that women receive training primarily at agricultural "collèges" and home economics schools.

TABLE 25. TARGETS FOR MALE AND FEMALE AGRICULTURAL EDUCATION IN ABOUT 1970

	LONG COURSE	SHORT COURSE	TOTAL
Men[1]	9,000	15,000	24,000
Women[2]	4,500	7,500	12,000
Total I.	13,500	22,500	36,000
II[3]	18,000	30,000	48,000
Current annual averages for girls[4]	negligible	3,000	3,000

1. Table 17 (total) rounded figures.
2. Based on 50 % of the figure for men.
3. Assuming 100% of male rates.
4. Calculated on the basis of Annex II (1964/65 enrolment in round figures).

102. Study of Table 25 shows how much will have to be done at the level of the long secondary course in order to narrow the 'training gap' between the two sexes.

b) *Vocational training*

103. Future farmers and farm workers who have been educated neither in a "collège" nor in a "lycée" should be able to get vocational training elsewhere.

At present, this is provided for by State and private establishments which run seasonal courses, either on a full- or a part-time basis (see Annex II—Vocational Training). These training courses are at present being re-organised, to a certain extent, in connection with 'social advancement' policy.

c) *Social advancement*

104. The basic legislation on social advancement consists of the Law of 31st July, 1959, and the Decree of 29th February, 1960, governing the application of that Law to agricultural occupations. Social advancement differs from ordinary schooling in several respects—the age of pupils, the teaching methods, the organisation of classes and the aims pursued. It includes both *occupational* (or individual) and *collective* advancement.

105. *Occupational advancement* consists of a general and technical programme of training to enable workers to acquire a skill or to specialise (short secondary course) or to obtain—at any time during their working life and by suitable means—training equivalent to that required for the various levels of technical training: "agents techniques" and "techniciens" (long secondary course) or agricultural graduates (the highest level of further education) and then to take up employment suited to their newly acquired ability.

106. *Collective advancement* is concerned with the training of men who will be responsible for running farmers' organisations such as unions, co-operatives and finance societies. It is concerned therefore with preparing people to accept organising responsibilities and with the advancement of the rural community as a whole. The role of unions in negotiations with the authorities, the adoption of new co-operative schemes and their contribution to rural development, new forms of syndicate farming, etc., all combine to make this form of advancement increasingly important for the rural community.

107. In 1963, the total number of administrative posts in farmers' unions, finance and co-operative societies and the agricultural credit corporations was around 600,000[1]. Assuming the average tenure of such posts to be about 20 years (it is in fact much more than this at present) and that there is no plurality of posts (which is not actually the case), the number of administrators to be trained for filling current vacancies would be about 30,000 each year. This figure is in fact much lower than the optimal one, since many of the present administrators have had no training, and in the present social and economic conditions many members of the farming community wish to benefit from such advancement. In order to transform itself, agriculture has a pressing need for a large number of men who can accept responsibility in this field. Monsieur Pisani, when he was Minister of Agriculture, recently stated that "social advancement will be to the Fifth Plan what education was to the Fourth". As has already been pointed out, the Fourth Plan saw agricultural education take a real step forward, and the Fifth Plan should be marked by the fresh impetus given to social advancement.

108. Since farmers and farm workers are highly receptive to social advancement schemes, the development of such schemes is likely to be hampered more by a shortage of funds than by anything else. Usually, these schemes take the

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[1] *Avenirs—La Promotion Sociale* (February/March 1963).

form of short training courses and they are expressed in terms of 'trainee-days'. The trainee-days are themselves classified under three headings— 'departmental', 'regional' and 'national'. It has been estimated that in 1964, 34,850 people participated in advancement schemes representing a total of 83,764 trainee-days. The estimates for 1966 are 85.000 participants and 364,500 trainee-days. Funds totalling Frs. 20,000,000 have been set aside for 1966 and are. due to be increased by 10 per cent per year, rising to Frs. 29,282,000 in 1970.[1]

3. DISCUSSION OF THE PROGRAMME AND PREREQUISITES FOR ITS FULFILMENT

109. The development of agricultural vocational and technical training, like that of education in general, is a budgetary problem. There being a strong desire in Western countries both for general education and for vocational training, the only limiting factor has been finance. For education, as for goods, the trend of the affluent society is towards mass consumption. Education, however, is different from the other items in that its development depends essentially on public funds. Making good use of human resources thus depends on Government initiative and especially on budgetary policy.

110. Given that the development of education is a budgetary matter, three fundamental questions arise:

i) What share of public funds should be allocated to education?

ii) How should funds be allocated between different forms of education (research, teaching, advisory work, advancement, others) and between different types of education (general, technical, agricultural) and between different levels (elementary, the short and long secondary course, short and long higher education)?.

iii) Should taxes or the role of private finance be increased in order to achieve educational objectives recognised as desirable?

111. To throw light on the answers to these questions, methodological research and the collection of data are essential. Despite the work done in this field in recent years, many factors are still unknown. The economist will have a natural tendency to calculate marginal productivity, but will find this extremely difficult to estimate. Even if such calculations were feasible, it must be remembered that education is not only an investment but also an item of consumption whose desirability cannot be assessed in terms of marginal productivity. The most practical approach as far as teaching is concerned is to determine the levels of qualification which are desirable from the point of view of social and economic development and employment programming.

112. However, this approach also comes up against obstacles. In the present state of our knowledge, the rates and levels of training are a mixture of the 'probable' and the 'desirable', and remain largely subjective. The establishment of development hypotheses for vocational and technical training has nonetheless the immense advantage of enabling us to assess, by reference to stated objectives, what resources are needed and thus to help plan an investment policy and provide economic arguments for those who put the case for the budget. On the basis of budgetary appropriations, either agreed or proposed, it is also possible to work out feasible targets and to allocate appropriations as effectively as possible between the various categories and levels of education.

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[1] *Paysans—La Promotion Collective* (No. 54, June/July, 1965).

113. In the context of the present study, we have constructed a 'reasonable' hypothesis: others could be established and put forward for discussion. Basically, however, the main purpose of this study is essentially methodological, to show that such a hypothesis could be established and, in so doing, to point to the difficulties and uncertainties involved.

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Annex I

A SURVEY OF THE EMPLOYMENT MARKET FOR AGRICULTURAL GRADUATES AND TECHNICIANS

The "Association pour l'emploi des cadres, Ingénieurs et techniciens de l'agriculture" (APECITA) was founded in July 1964 for the purpose of providing information, acting as a clearing house for vacancies and those seeking employment, arranging transfers and offering vocational guidance[1]. It carried out a census by occupational categories in 1962, and attempted to identify the medium-term trend up to 1967[2]. The forecast was necessarily confined to the near future because of several factors e.g. uncertainty about the methods used (this was the first study of its kind made in France), the 'changing face' of agriculture, the effect of the European Economic Community and the current structural reforms of agricultural education. It is clear that a longer-range study is needed to help orientate teaching programmes and determine the basic policy alternatives facing agricultural education.

The survey was based on a questionnaire, of which 30,000 copies were sent out, replies being received from 7,000 enterprises. The object was to make a census of the situation in 1962, to describe the situation in 1957, and to make a forecast for 1967. For each of these three years, the study covered the educational background, function and age of the personnel concerned. For 1962 their distribution by regions was established.

The age pyramid enabled the replacement need to be estimated, and projections up to 1967 were made with the help of the relevant professional associations whenever it was felt that the replies were sufficiently representative. The growth forecasts, therefore, are based on the recruitment forecasts made by the employers themselves.

The main results of the survey are set out in the following tables and diagrams (see also Chart 3 in text). Many reservations must be made about the results obtained, but the survey and the resulting projections indicate some trends and give food for thought[3].

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[1] Office at 11, rue de Clichy, Paris 9.

[2] APECITA — *Étude sur le marché du travail des cadres de l'agriculture, des industries agricoles et alimentaires et du secteur para-agricole, 1957, 1962 et 1967.*

[3] Fuller discussion of some of the problems raised by this type of survey will be found in Appendix II.

Table 1. CLASSIFICATION OF EMPLOYERS OF AGRICULTURAL GRADUATES AND TECHNICIANS (APECITA SURVEY)

A. Government service

- *a*) Central Government
- *b*) Directorate of Agricultural Services
- *c*) Forests and Waterways Department
- *d*) Education
- *e*) Rural Works Department
- *f*) National Stud
- *g*) Inspectorate of Welfare Legislation
- *h*) Plant Protection Service
- *i*) Fraud Prevention Department
- *j*) Veterinary Services
- *k*) Préfecture of the Seine Département.

B. Public corporations

- *a*) Caisse Nationale de Crédit Agricole
- *b*) Compagnie d'Aménagement et Société d'Equipement
- *c*) Crédit Foncier de France
- *d*) Institut National de la Recherche Agronomique
- *e*) Office National Interprofessionnel des Céréales
- *f*) Section d'Application de la Recherche à la Vulgarisation
- *g*) Société Nationale des Chemins de Fer.

C. Farmers' organisations

Agricultural associations

- *a*) National
- *b*) At Département level
- *c*) Chambers of Agriculture

Co-operative Organisations

- *d*) Confédération Générale des Coopératives Agricoles
- *e*) Wine-merchants and Distilleries
- *f*) Cereals and farm requisites
- *g*) Stockbreeding and Artificial Insemination
- *h*) Marketing and Processing
- *i*) Dairy Products
- *j*) Société d'Intérêts Collectifs Agricoles
- *k*) Milk Inspection
- *l*) Agricultural Credit
- *m*) Free Loan Agencies
- *n*) Finance Societies
- *o*) Société d'Aménagement Foncier et d'Établissement Rural

Advisory work

- *p*) Centre of Agricultural Technical Studies
- *q*) Management Centres
- *r*) Agricultural Productivity Groups
- *s*) Breeding Stations

D. Food and agriculture industries

- *a*) Animal Feedstuffs
- *b*) Biscuit Makers
- *c*) Broths and Soups
- *d*) Brewing
- *e*) Coffee
- *f*) Cidermaking
- *g*) Canning and Preserves
- *h*) Refrigeration
- *i*) Spices and Seasoning
- *j*) Milk and Milk Products
- *k*) Starch Products

l) Dairy and Poultry Products
m) Meat Curing and Salting
n) Sugar Manufacturing and Distilling

E. FARMS

F. RELATED INDUSTRIES

a) Fertilizers
b) Laboratories—Chemicals
c) Machinery

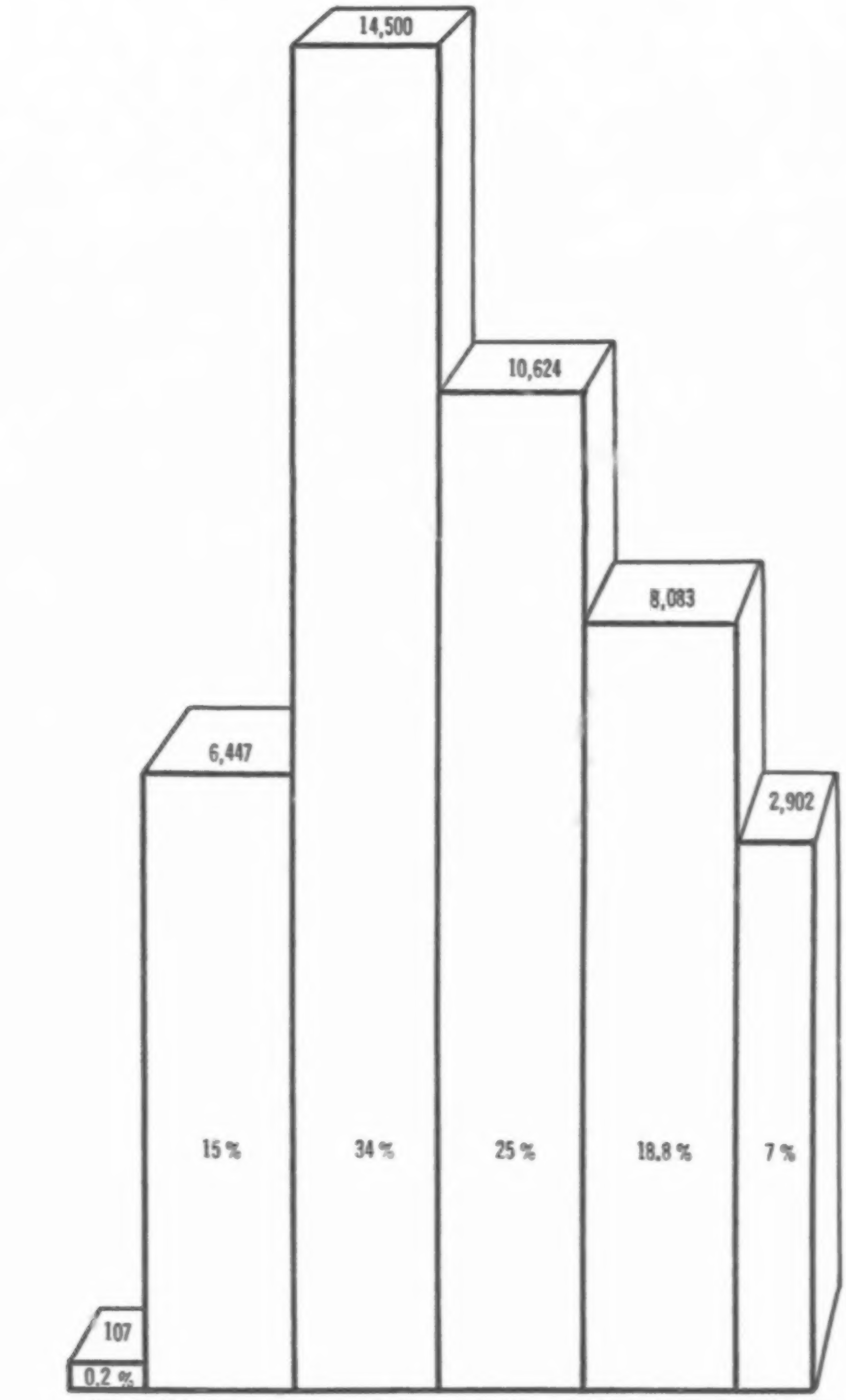
G. OVERSEAS

a) Corps Autonome
b) Research Institutes
c) Nationalised and semi-public Companies
d) Private Employers

H. MISCELLANEOUS

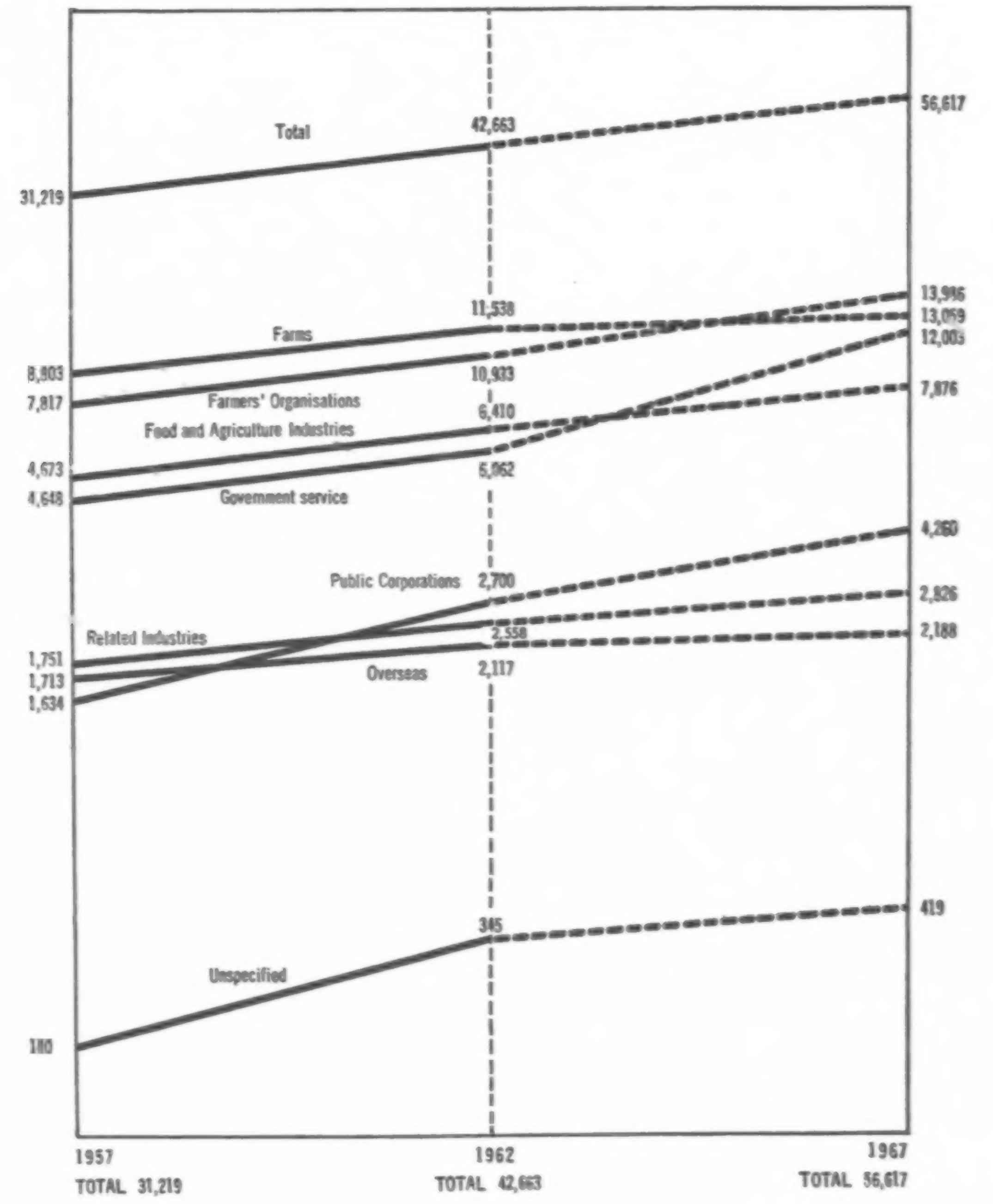
a) Insurance Companies
b) Study Bureaux

Diagram I. DISTRIBUTION OF AGRICULTURAL GRADUATES AND TECHNICIANS BY AGE GROUPS IN 1962



Note: Fifty percent of agricultural graduates and technicians are over 40 years of age, but the age pyramid differs from one branch to another (APECITA has constructed a pyramid for each branch).

Diagram II. TREND BY SECTORS OF AGRICULTURAL GRADUATES AND TECHNICIANS IN FARMING, FOOD AND AGRICULTURE INDUSTRIES, AND RELATED ACTIVITIES



Annex II

STATISTICS ON THE DEVELOPMENT OF AGRICULTURAL EDUCATION

NUMBER OF STUDENTS IN STATE AGRICULTURAL COLLEGES

I. MALE STUDENTS

A. HIGHER AGRICULTURAL EDUCATION

ESTABLISHMENT	NO. OF STUDENTS		% INCREASE
	1963/64	1964/65	
Institut National Agronomique	370	400	8.1
Écoles Nationales Supérieures Agronomiques:			
Grignon	173	194	12.1
Montpellier	164	186	13.4
Rennes	120	152	26.7
École Nationale Supérieure des Industries Agricoles et Alimentaires	122	138	13.1
École Nationale Supérieure d'Horticulture, Versailles:			
Normal course	142	139	2.1
Section du Paysage et de l'Art des Jardins	24	24	—
École Nationale d'Ingénieurs des Travaux Agricoles, Bordeaux[1]	98	144	46.9
Total	1,213	1,377	13.6

[1] Two classes graduated in 1963/64, three in 1964/65.

Source: Bulletin d'Information du Ministère de l'Agriculture.

B. VETERINARY COLLEGES

ESTABLISHMENT	NO. OF STUDENTS		% INCREASE
	1963/64	1964/65	
Écoles Nationales Supérieures Vétérinaires:			
Alfort	465	476	2.4
Lyons	264	264	—
Toulouse	295	350	18.6
Total	1,024	1,090	6.4

C. TECHNICAL EDUCATION FOR AGRICULTURE

TYPE OF ESTABLISHMENT	NO. OF STUDENTS		% INCREASE
	1963/64	1964/65	
Lycées and preparatory classes for higher agricultural education	5,352	6,699	25
Collèges[1]	1,336	1,972	48
Specialised schools	421	548	30
Total	7,109	9,219	30

[1] Including those in overseas departements.

D. VOCATIONAL TRAINING

The 1964 intake to the part-time agricultural vocational training and education establishments showed a 10 per cent increase over the 1963/64 figure.

There are 148 permanent or itinerant winter schools of agriculture, where the number of students rose from 6,500 to 7,142 (+9 per cent).

In the 320 specialised seasonal courses, the number of students rose from 7,000 to 7,500.

II. FEMALE STUDENTS

A. HIGHER EDUCATION

ESTABLISHMENT	1st YEAR	2nd YEAR	3rd YEAR	TOTAL
École Nationale d'Enseignement Ménager, Coetlogon	—	30	—	30
École Nationale Supérieure Féminine d'Agronomie, Rennes	13	—	—	13
École Nationale Féminine d'Agronomie, Toulouse	11	29	29	69
École Nationale Féminine d'Agronomie, Clermont-Ferrand[1]	34	—	—	34

[1] Opened in 1964.

B. TECHNICAL AGRICULTURAL EDUCATION

TYPE OF ESTABLISHMENT	NO. OF STUDENTS 1963/64	NO. OF STUDENTS 1964/65	% INCREASE
Lycée	—	30	—
Collèges	2,494	3,089	23.9
Home Economics Schools:			
2-year course	1,049	1,101	5.0
1-year course	1,146	1,280	11.7
Total	4,689	5,500	14.3

III. NUMERICAL TREND OF ESTABLISHMENTS PROVIDING TECHNICAL AGRICULTURAL EDUCATION, 1963/64 AND 1964/65

TYPE OF ESTABLISHMENT	1963/64	1964/65
Boys		
Agricultural Lycées	28	38
Agricultural Collèges	23	22
Specialised Schools	10	10
Total	61	70
Girls		
Agricultural Lycées	—	1
Agricultural Collèges	39	45
Home Economics Schools:		
2-year course	17	24
1-year course	47	34
Total	103	104

Annex III

TREND OF GOVERNMENT AID TO AGRICULTURE

Millions of francs.

TYPE OF EXPENDITURE	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Market support	233.64	401.03	447.19	432.76	537.19	556.28	827.70	1,449.00	1,851.50	1,513.00	2,244.00
Social welfare schemes	561.82	797.27	1,054.14	1,292.43	1,451.18	1,437.63	1,618.15	1,743.52	2,494.09	3,110.08	3,278.25
Action on farm structure and miscellaneous	649.75	1,081.62	1,596.50	1,802.36	1,587.60	1,465.18	1,666.26	1,714.51	2,066.75	2,596.64	2,069.39
Research and education	20.36	31.09	31.77	40.31	39.38	49.47	73.06	101.48	144.02	278.22	306.43
Advisory work	18.86	27.82	26.77	43.92	62.70	60.50	49.42	60.12	87.61	89.65	74.79
Sub-total	*39.22*	*58.91*	*58.54*	*84.23*	*102.08*	*109.97*	*122.48*	*161.60*	*231.63*	*367.87*	*381.22*
Grand total	1,484.43	2,338.83	3,156.37	3,611.78	3,678.05	3,569.06	4,234.59	5,068.63	6,643.97	7,587.59	7,972.86
Sub-total as % of grand total	*2.64*	*2.51*	*1.85*	*2.33*	*2.77*	*3.08*	*2.89*	*3.18*	*3.48*	*4.84*	*4.78*

Annex III

TREND OF GOVERNMENT AID TO AGRICULTURE

Millions of francs.

TYPE OF EXPENDITURE	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Market support	233.64	401.03	447.19	432.76	537.19	556.28	827.70	1,449.00	1,851.50	1,513.00	2,244.00
Social welfare schemes	561.82	797.27	1,054.14	1,292.43	1,451.18	1,437.63	1,618.15	1,743.52	2,494.09	3,110.08	3,278.25
Action on farm structure and miscellaneous	649.75	1,081.62	1,596.50	1,802.36	1,587.60	1,465.18	1,666.26	1,714.51	2,066.75	2,596.64	2,069.39
Research and education	20.36	31.09	31.77	40.31	39.38	49.47	73.06	101.48	144.02	278.22	306.43
Advisory work	18.86	27.82	26.77	43.92	62.70	60.50	49.42	60.12	87.61	89.65	74.79
Sub-total	*39.22*	*58.91*	*58.54*	*84.23*	*102.08*	*109.97*	*122.48*	*161.60*	*231.63*	*367.87*	*381.22*
Grand total	1,484.43	2,338.83	3,156.37	3,611.78	3,678.05	3,569.06	4,234.59	5,068.63	6,643.97	7,587.59	7,972.86
Sub-total as % of grand total	*2.64*	*2.51*	*1.85*	*2.33*	*2.77*	*3.08*	*2.89*	*3.18*	*3.48*	*4.84*	*4.78*

2

SWEDEN

by

G. ERICSSON and F. PETRINI

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SWEDEN

by

G. ERICSSON and F. PETRINI

1. RECENT TRENDS IN SWEDISH AGRICULTURE

1. THE PRESENT SITUATION

1. In general, the labour supply is the most important single factor affecting the prosperity of agriculture (apart from specific measures in governmental agricultural policy). Indeed, in Sweden this fact is probably of greater importance than in other countries, given the declared objectives of Swedish agricultural policy. These are[1]:

- *i*) Total agricultural production should not be greater than the domestic market can absorb.
- *ii*) Farmers operating farms of specified size with reasonable efficiency should obtain income parity with workers in industries located outside the main towns.
- *iii*) Through improved farm structure and layout, efficient one and two-family farms should be created, and marginal farm land should be transferred to other uses.

2. The broad objectives of Swedish employment policy for the economy as a whole are twofold[2]:

- *i*) Long-term: Each person who wants and is able to work should have the opportunity of finding a satisfactory employment in the labour market.
- *ii*) Short-term: The number of vacancies and the number of unemployed should be reduced to a minimum.

3. When persuing these goals, both the possible ways are used, viz moving employment opportunities to where the labour force is, and helping the labour force to move to where the jobs are. The decision as to which method should receive priority is taken within the framework of a classification of urban centres on the basis of their populations. The main centres, "A-centres", are those which can draw upon a population which exceeds 30,000 persons including those inhabitants outside the centre who spontaneously utilise the centre. In the same way "B" and "C" centres are defined with population above 15,000 and 7,000 inhabitants respectively.

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[1] SOU ("Official Government Investigation" series, subsequently referred to as "SOU"), 1946: 42,46. Riktlinjer för den framtida jordbrukspolitiken. (Guidelines for future agricultural policy).

[2] SOU 1963: 58. Aktiv lokaliseringspolitik (Active localisation policy).

4. Against this background, it will be evident that some assessment of the likely future flow of labour into and out of agriculture is an indispensible part of even the broadest programming of the economy's future prosperity.

5. During the last twenty years several changes have occurred in Swedish agriculture. These changes can be summarised the following way[1]:

i) An improvement in production techniques. With 1938/39 = 100, the input per farm in 1959/60 of machinery and electrical power was 304, of feedingstuffs 271, and of fertilisers 315. The increase in yield per hectare of wheat was 0.1 per cent per year during the same period. This change is less than that of the yield per cow where the increase was 1.1 per cent per year. The difference is partly due to the fact that the increased amount of purchased inputs devoted to cereals was to a large extent used for substitution of other, more expensive input factors, mainly labour.

ii) An improvement in labour productivity. During the period already mentioned and on the same basis, the input per farm of labour decreased to 73. Mechanisation, more efficient labour methods, technical improvements in the design of farm buildings, improved farm layout, and out-migration—all these circumstances explain this change in labour efficiency. The rapid mechanisation in Swedish agriculture can be seen from the figures of tractor numbers. The total number was 23,000 in 1940 and 153,000 in 1960. The corresponding figures for combines are 100 and 25,000. The labour force in agriculture decreased by 3.8 per cent annually during the period 1952-62. Hired labour accounts for the largest decline, 5.5 per cent per year, while the corresponding figure for farmers and members of their families is about 3 per cent.

TABLE 1. FARM DISTRIBUTION BY SIZE-GROUP: 1961

SIZE-GROUP IN HECTARES ARABLE LAND	NUMBER OF FARMS, PER CENT OF TOTAL 1961	NUMBER OF FARMS, PERCENTAGE CHANGES 1937-1961	AREA OF ARABLE LAND, PER CENT OF TOTAL 1961
2.1 – 5	28.7	– 41.4	7.6
5.1 – 10	32.3	– 22.9	17.4
10.1 – 20	22.9	– 11.6	24.0
20.1 – 30	7.8	+ 4.2	13.9
30.1 – 50	5.1	+ 9.4	14.0
50.1 – 100	2.3	+ 6.5	11.3
Over 100	0.9	– 4.7	11.8
Total	100.0	– 24.2	100.0

Source: Jordbruksräkningen 1961.

iii) An increase of the average size of farms. In Table 1 the size distribution of farms and the size changes can be seen. There is a very strong decrease in the number of small farms during the period studied, but

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[1] If no reference is given the data can be found in SOU 1963: 66.

Table 2. TOTAL NUMBER OF FARMS: 1962-1964[1]

SIZE-GROUP IN HECTARES (FOREST AREA)	SIZE-GROUP IN HECTARES (ARABLE LAND)								
	2.1-5.0	5.1-10.0	10.1-15.0	15.1-20	20.1-30.0	30.1-50.0	50.1-100.0	OVER 100	TOTAL
0	16,118	13,605	9,435	6,481	7,390	5,757	2,881	929	62,596
1- 5	9,592	6,031	2,857	1,623	1,307	674	203	37	22,324
6- 10	8,370	6,753	3,032	1,569	1,362	621	205	36	21,948
11- 25	14,772	15,620	6,845	3,736	3,120	1,621	490	108	46,312
26- 50	10,074	15,331	6,242	3,282	2,851	1,732	577	126	40,215
51- 75	3,462	6,313	2,831	1,415	1,175	808	412	95	16,511
76-100	2,080	3,132	1,513	758	540	428	245	102	8,798
101-200	2,830	3,525	1,556	789	650	487	425	245	10,507
201-400	883	940	351	195	148	135	137	207	2,996
Over 400	163	197	38	37	34	39	63	268	889
Total	68,344	71,447	34,750	19,885	18,577	12,302	5,638	2,153	233,096

[1] The analysis was made on the basis of separate county data and these were not all available for a single year.

Source: Statistiska Meddelanden 1964: 31.

still 61 per cent of the farms are below 10 hectares. The change in size-group distribution has resulted in an increase in the area of arable land per farm from 11.7 hectares in 1937 to 14.2 hectares in 1961. The effort to increase farm size reflects the fact that the earning capacity is nearly twice as high in the group of 30-50 hectares as in the group of 5-10 hectares. The total number of farms in 1961 was 232,920 above 2 hectares[1].

In Table 2 the total number of farms classified by the area of both arable land and forest land can be seen. The figures refer to the period of 1962-64[2]. It can be seen that most farms have below 50 hectares of forest land. Due to the small average sizes of farms, a large proportion (about 30 per cent) of farmers work partly outside their holding. The following figures show the development between 1958 and 1961 for the group above 2 hectares where the farmers generally both own and operate their land[3]:

CATEGORY	PER CENT OF THE FARMERS STUDIED
No work outside the farm in either year:	62.4
No change in amount of work outside the farm:	14.7
Increase in amount of work outside the farm:	13.8
Reduction in amount of work outside the farm:	9.1
	100.0

A slight increase in size can also be seen in the average number of animals per farm. For pigs the figure has changed from 4.2 in 1937 to 7.1 in 1960 and for hens the figures are 20.3 and 23.3. For all cows taken together, the figures are 5.7 cows per farm in 1937 and 4.7 in 1960. The number of farms without cows has changed from 2.8 per cent in 1937 to 21.4 per cent in 1960.

iv) A decrease in the total farm-land area. In 1961 the area of arable land was 3,296,600 hectares[1]. In 1962, 137,200 hectares of arable land and 42,900 hectares of pasture were unused. During the period 1958-61 24,000 hectares of arable land and 20,550 hectares of pastures were afforested[3].

v) A growing specialisation of production. In animal husbandry, pork production has increased rapidly since 1938/39. During the 10-year period 1952-61, the raising of young stock for slaughter increased 6.2 times and the number raised in 1961 was 196,760. Among crops, the introduction of oil-plants during World War II, and the field-scale cultivation of vegetables and strawberries are particularly striking. The total picture of Swedish agriculture shows, however, rather small changes, as can be seen in Table 3.

vi) A continuing process of integration. The co-operative movement among farmers has been well developed during the whole period discussed here. New forms of horizontal integration have occurred, however, particularly for common machine use and common management of forest areas. The latter type of integration has increased from 8,000 hectares of forest land in one region in 1955 to 673,000 hectares—6 per cent of all privately owned forest land—and 162 regions in 1962. Vertical integration has particularly occurred in connection with the cultivation of peas and berries, through contracts with food preserving factories. (For sugar beet, potatoes for manufacturing, and seed this kind of integration has already existed for a long time.) Finally, in broiler production a similar type of contracting is common. In 1961/62, 50 per cent of the total ouput of broilers was produced by 'factories', 40 per cent by farmers under contract with 'factories' and only 10 per cent by enterprises without such an agreement.

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[1] Jordbruksräkningen 1961.

[2] The analysis was made on the basis of separate county data and these were not all available for a single year.

[3] Petrini 1964.

TABLE 3. USE OF CROP LAND AND NUMBER OF LIVESTOCK IN 1937 AND 1961

PRODUCT	UNITS	1937	1961
Bread grain	000 ha.	490	349
Feed grain	000 ha.	975	1,103
Forage plants[1]	000 ha.	1,621	1,366
Leguminous plants	000 ha.	24	18
Potatoes and other root crops	000 ha.	241	162
Other crops	000 ha.	8	105
Horses	000 head	633	166
Cattle	000 head	2,986	2,327
Sheep	000 head	353	134
Pigs	000 head	1,425	1,974

1. Green crops and leys for pasture, hay and silage.
Source: Jordbruksräkningen 1937 and 1961.

2. CONSEQUENCES AND IMPLICATIONS FROM THE EDUCATIONAL POINT OF VIEW

6. The discussion of the present agricultural situation in Sweden gives the following conclusions of relevance to educational planning:

i) One-family farms will continue to be the prevailing type, and two-family farms will to an increasing extent occur in the future.
ii) The total volume of production will not increase.
iii) Individual farms will be stimulated to enlarge their area considerably, if possible from the 1961 average of 14 ha to something like 50 ha.
iv) The intensity of production will be increased within farms.
v) The transfer of resources, mainly land and manpower, out of agriculture will be stimulated.
vi) There will be an increased tendency for specialisation in production.
vii) The tendency to horizontal integration will continue.
viii) An increased proportion of full-time commercial enterprises.
ix) For those farms that have significant areas of forest land, greater importance will be given to an economic programme for the combined holding.
x) The further enlargement of farms will call for increased capital per farm.

xi) The ancillary branches serving agriculture (suppliers of requisites, marketing and processing firms, advisory services etc.), will increase in importance.

As a result of all these conditions, the educational level of those staying in agriculture will have to be raised substantially.

II. PRESENT SITUATION OF AGRICULTURAL EDUCATION

1. GENERAL ORGANISATION OF THE NATIONAL EDUCATIONAL SYSTEM

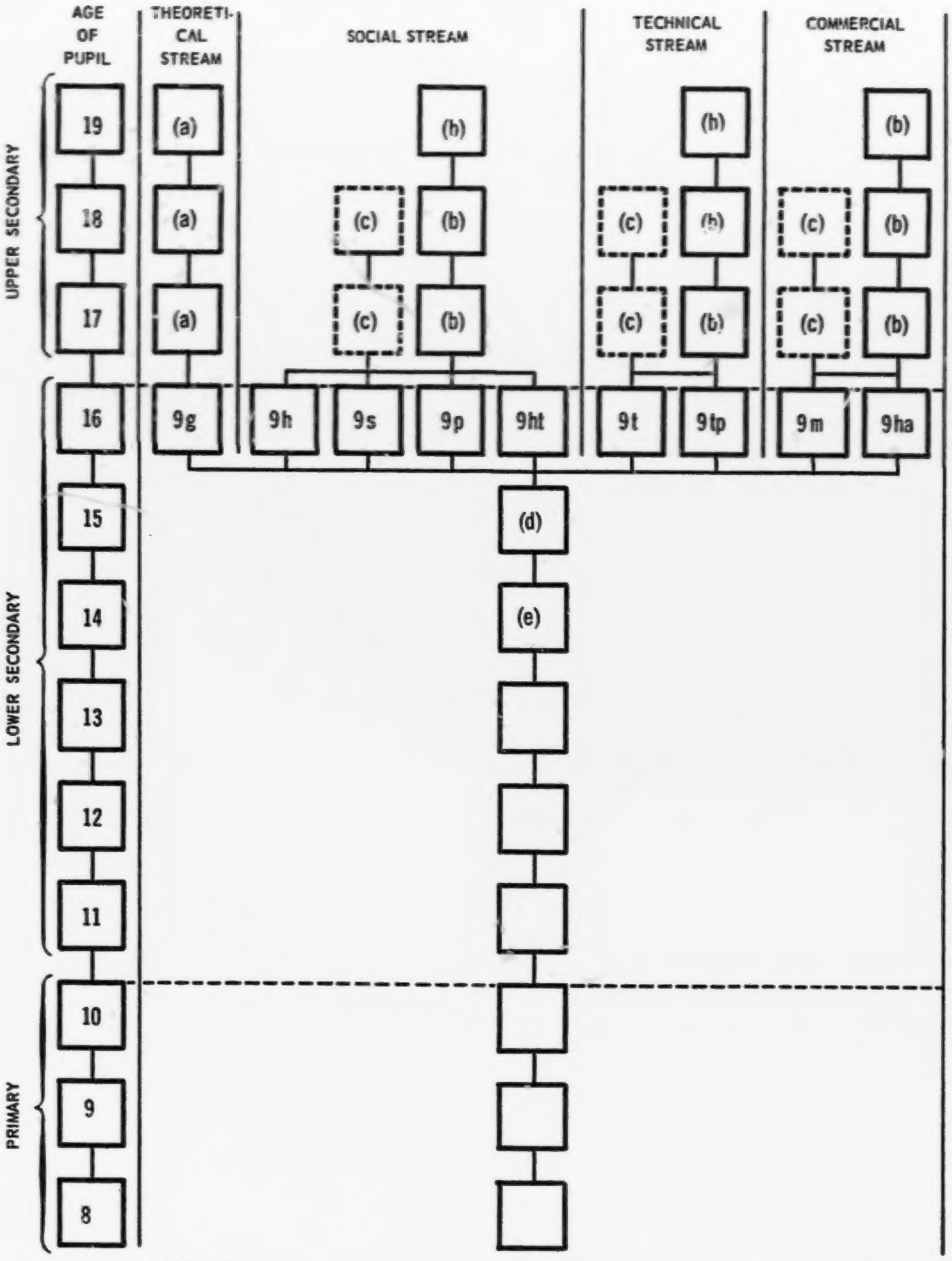
7. The various forms of vocational training have to be adjusted to the general basic education provided for all pupils. In Sweden, a reform of primary and lower secondary school education has been carried out in the last few years, the aim being that all children, whether living in towns or in rural areas, shall receive an similar nine-year general basic education—primary and lower secondary school education. The upper stage of this education takes place in central schools, where pupils are transported daily or where they live as boarders. This upper stage is frequently coupled with a higher secondary school and/or a vocational school.

8. Chart 1 shows the organisation of primary and secondary education. It shows that during the first eight years, pupils are kept together in the same 'stream'. For the last two of these years they may however choose between various subjects. Before entering the seventh form, they may choose optional subjects from five different combinations for five weekly periods, primarily in the matter of foreign languages. Before entering the eighth form they may, according to their individual plans for future studies, choose optional subjects from nine different combinations for seven weekly periods.

9. During the ninth year, the education is divided between four different streams. The first stream (9 g) is the one preparing pupils for entry to grammar schools. From the ninth form, children can go directly to a three-year higher secondary school, called "gymnasium" after which they should be qualified for entry to universities and colleges. In the second stream, the social one, there are two sides with a theoretical bias, the classical side (9 h), and the social-economic side (9 s), and two sides with a practical bias, viz. a general practical side (9 p), and a domestic science side (9 ht), which provide a broad basic education with a vocational bias, but without preparation for any specific vocation. In the practical sides, 22 of the 35 weekly periods are devoted to vocational subjects. The third stream is directed towards "techno-mechanical" vocational sectors and is divided into a theoretical (9 t) and a practical (9tp) side. The last stream, the fourth, is directed towards commercial-vocational and is also divided into a theoretical side (9 m) and a practical one (9 ha). Normally, no vocational training in the proper sense is started until *after* the ninth school year. The practical vocational instruction provided *during* the ninth year has to a large extent the character of continued 'vocational orientation' towards a wide range of possible forms of more specialised training.

10. In the recent re-organisation, the former modern school ("realskolan") was abolished with its general theoretical stream and its vocational bias (com-

Chart. 1 PRIMARY AND SECONDARY EDUCATION IN SWEDEN


AGE OF PUPIL
THEORETICAL STREAM
SOCIAL STREAM
TECHNICAL STREAM
COMMERCIAL STREAM
UPPER SECONDARY
LOWER SECONDARY
PRIMARY
19
18
17
16
15
14
13
12
11
10
9
8
(a)
(a)
(a)
(h)
(c)
(b)
(c)
(b)
(h)
(c)
(h)
(c)
(b)
(b)
(c)
(b)
(c)
(b)
9g
9h
9s
9p
9ht
9t
9tp
9m
9ha
(d)
(e)

(a) Gymnasium.
(b) Vocational training may be given either for one year between the two Fackskola years, for one year after Fackskola, or for up to three years after lower secondary school.
(c) Fackskola social continuation school with a vocational bias. See also Note (b).
(d) Optional subjects for 7 out of 35 weekly periods.
(e) Optional subjects for 5 out of 35 weekly periods.

merce and technology). Its place has been taken by new forms of voluntary, theoretical, advanced training with a vocational bias, viz. by two-year continuation schools ("fackskolor") during the tenth and eleventh school years. Such continuation-school education will be available for three of the four streams with a vocational bias, viz. for the social, technical and commercial streams. The number of persons in the various sectors of education and their distribution by age-groups are shown in the following charts. These also show projections to 1970.

11. In 1960 the population of Sweden was about 7.5 million and it is estimated that by 1980 this figure will have increased to some 8.5 million. In 1980 a great number of bays and girls will be attending "gymnasia" and "fackskolor" during their 10th and 11th school-years. For vocational education, this will probably mean that in the more specialised courses there will be students who have already attended a "fackskola".

12. Education in Sweden is free for students and the costs are divided between the central and local government authorities. There are very few private schools. Beside running costs and investment costs for buildings and equipment, the maintenance system for students means rather high expenditure. The following data show the cost of current expenditure on education in the year 1958.

TABLE 4. CURRENT EXPENDITURE FOR EDUCATION IN 1958

S. Kr. million.

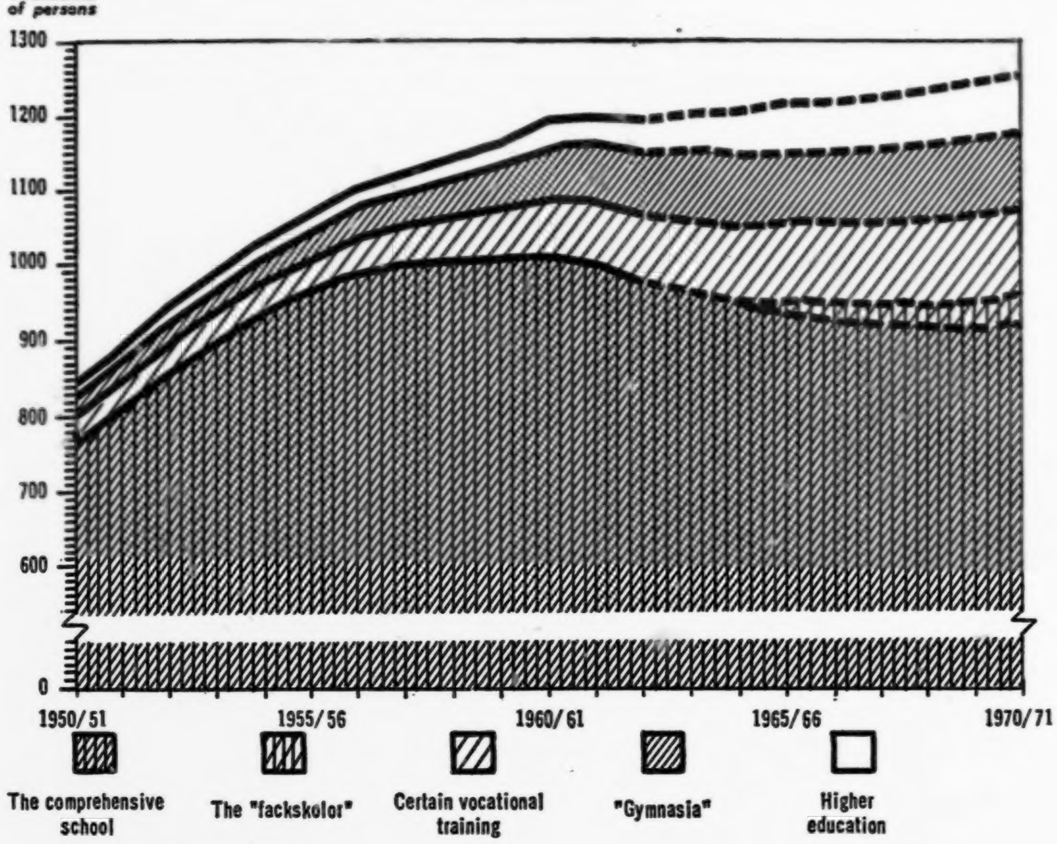
PURPOSE	CENTRAL GOVERNMENT EXPENDITURE	LOCAL COMMUNITY EXPENDITURE	TOTAL	PERCENTAGE
Compulsory education	43.0	1,256.2	1,299.2	60.6
Optional school	191.3	117.4	308.7	14.4
Vocational training	26.6	164.2	190.8	8.9
Higher education	112.5	1.4	113.9	5.3
Other education	37.7	151.1	188.8	8.8
Public libraries	0.3	41.9	42.2	2.0
Total	411.4	1,732.2	2,143.6	100.0
Percentage	19.2	80.8	100.0	—

Source: Swedish memorandum to OECD, on "Educational Policy and Planning".

13. In Table 4 capital costs and State transfers to private schools and to local authorities have not been taken into consideration If a correction is made for this, we get the figures in Table 5.

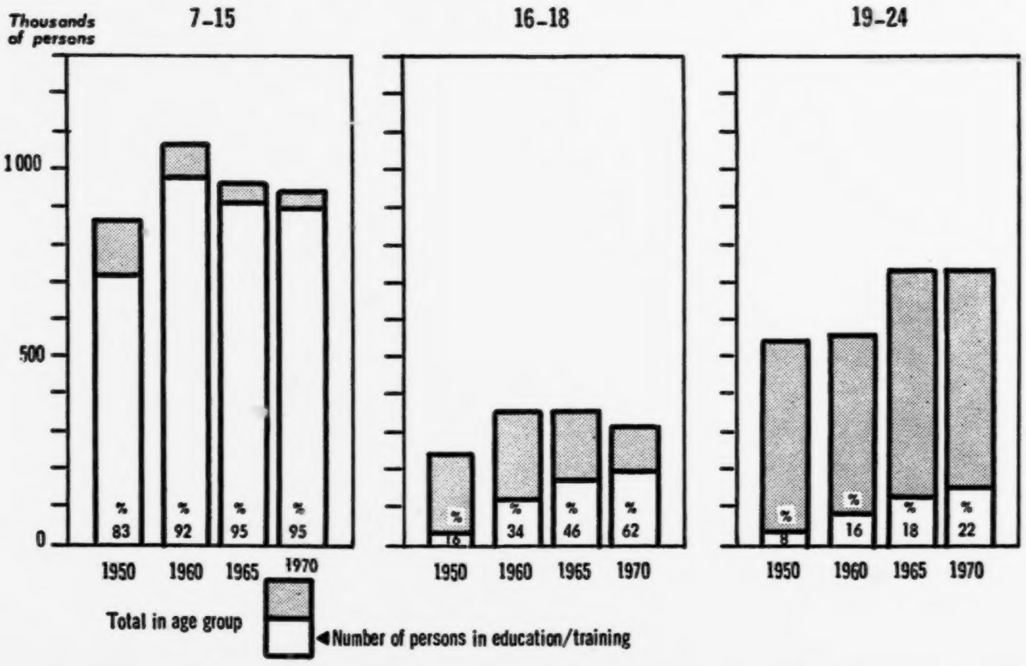
14. In 1960, public expenditure for education was calculated at 2,430 million Swedish Kronor (not including expenditure on kindergartens and day-nurseries), and this expenditure was expected to increase by 3.9 percent per year during the period 1960-65 up to 2,940 million Swedish Kronor in 1965, at 1960 prices. Expenditure for educational purposes constituted 27.5 percent of government current civil expenditure in 1960—the same proportion as in 1958. In the long-term programme "The Swedish Economy, 1960-65", this expenditure was estimated to amount to 31.6 percent of total government current civil expenditure in 1965, i.e. an increase of about 4 percentage points. In 1960, current expen-

Chart 2. NUMBER OF PERSONS IN DIFFERENT BRANCHES OF EDUCATION 1950-1970



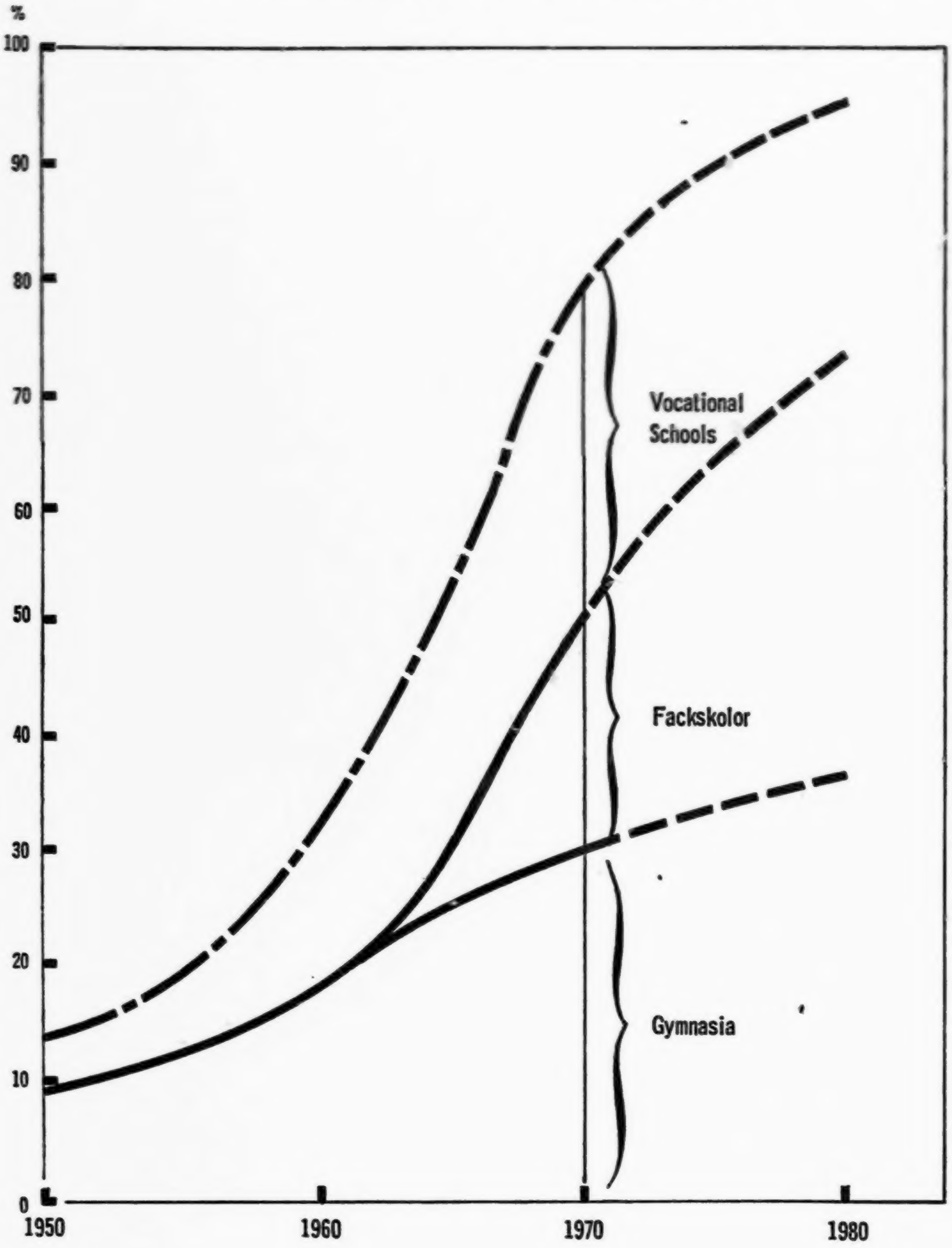
Source: See below.

Chart 3. NUMBER OF PERSONS UNDERGOING EDUCATION, BY AGE-GROUP 1950-1970



Source: *"Educational Policy and Planning in Sweden"* (Swedish Memorandum to OECD, January 1964).

Chart 4. NUMBER OF STUDENTS WHO BEGIN THEIR STUDIES IN "GYMNASIA", "FACKSKOLOR" AND VOCATIONAL SCHOOL AS PER CENT OF THE TOTAL NUMBER OF PUPILS IN THE CORRESPONDING AGE GROUPS IN YEAR OF ADMISSION



Source: **Government Budget Proposals for 1965/66 (Statsverkspropositionen år 1965 Bil. 10: Ecklesiastikdepartementet.**

diture for educational purposes was about 3.5 percent of the gross national product, and this proportion was expected to remain unaltered up to 1965, according to the long-term programme, calculated in constant prices and salaries. There is reason to suppose that the acual development has been more rapid than was predicted in the long-term programme.

TABLE 5. TOTAL EXPENDITURE FOR EDUCATION IN 1958,
INCLUDING CENTRAL GOVERNMENT TRANSFERS
TO LOCAL AUTHORITIES AND TO PRIVATE INSTITUTIONS

S. Kr. million.

PURPOSE	CENTRAL GOVERNMENT EXPENDITURE	LOCAL COMMUNITY EXPENDITURE	TOTAL
Current expenditure	411.4	1,732.2	2,143.6
Capital investment	45.5	343.3	388.8
Transfer payments to private persons and educational establishments	134.9	0.7	135.6
Central Government transfers to Local Authorities	920.9	− 920.9	—
Total	1,512.7	1,155.3	2,668.0
Percentage	56.7	43.3	100.0

Source: Swedish Memorandum to OECD, on "Educational Policv and Planning".

2. THE ORGANISATION OF AGRICULTURAL EDUCATION

a) *General*

15. The account above shows that no provision is made for agriculture in the preparatory vocational education given during the ninth school-year within compulsory schooling. There are those who maintain that the education provided in the technical stream would constitute a suitable vocational preparation for young future farmers. The experience gained from parents' recommendations to their children in the matter of education makes us believe, however, that in practice the vocational schools in agriculture will in the first place receive pupils from all the theoretical sides and in addition pupils from the general-practical and the technical-practical sides. Vocational orientation must be provided during the seventh and eight school-years, but this orientation is given for all vocational branches by one and the same instructor—a vocational counsellor and in these circumstances the likelihood of agriculture receiving the attention that perhaps it ought is obviously rather slight. The new educational system offers all children the possibility of choosing any vocation they may wish, irrespective of where they live or of the station in life of their families. The 'natural' recruitment to agriculture which was the normal course of evolution in the past and which, at least partly, was due to the difficulty of finding suitable alternative occupations no longer occurs to the same extent as before. Neither are relative earnings in agriculture so high that the best youths will always be attracted. These facts add force to the demand for some specific and attractive agricultural vocational training.

16. The effects of the historical background upon the form of agricultural vocational training have been noticeable up to the present time. Most of this education has been given in five-month winter courses, i.e. during a season

when, because of the climate, activity in Swedish agriculture is at its lowest. Training has to a great extent been given in the form of theoretical classroom instruction, in which general subjects and science occupied a substantial part of the time. Most pupils were over 20 years of age. To qualify, pupils needed to have a good practical knowledge of farming before entering school. The objective of the education was to improve their theoretical and practical knowledge for the successful management of their own farm. It has been found, however, that many of the pupils attending those courses later on pursue more advanced theoretical studies in other fields than agriculture.

17. In 1962, the Swedish Parliament decided that agricultural education should be re-organised along the following lines:

i) a direct connection should be established with primary and lower secondary school education ("grundskolan");

ii) education below university-level should be arranged in a fixed educational schedule with courses on various levels, but which should be interrelated with each other;

iii) practical training at the lower levels should be extended.

The guiding principles for this re-organisation and the present course of agricultural vocational training in Sweden are summarised below.

18. From the point of view of 'educational philosophy', agriculture has to accept the general principles in the other branches of vocational training, since agriculture has to 'compete' with them for pupils. That means that we must not create a vacuum between compulsory school education and agricultural vocational training. The first vocational education experienced by pupils should be practical and give them skill in the most common routines and an understanding of the reason why they have to be done. It is no longer sufficient to expect pupils to do all their practical work with farmers; on farms there is no uncomplicated work of the type essential to training in a new skill for such pupils. The school has therefore to an increasing extent to take over that part of their training. (Swedish trials with apprenticeship conducted on the pattern followed in some other countries were not very successful.)

19. The winter courses or one-year courses, which have been a predominant feature of our educational system, do not provide a sufficiently through education for the would-be farmer or farm worker, but have to be followed-up by further training. In view of the increasing rate of specialisation, which is one of the characteristics of modern agriculture, this further training should be provided in the form of courses with a specialist bias. The courses should preferably not be of too long a duration and should, as is the case with existing courses, take place during the comparatively quiet winter half-year.

20. The instruction should give more emphasis to economic questions. The profitability of the individual farm will depend entirely upon the manner in which available resources are combined, and that is particularly the case in regard to one of those resources, viz. human labour. Technical questions should nevertheless be given adequate attention.

b) *The Different Levels of Agricultural Education*

21. The relationships between the various levels of agricultural education that are available after the ninth year of compulsory schooling are shown in

Chart 5. AGRICULTURAL TRAINING IN SWEDEN

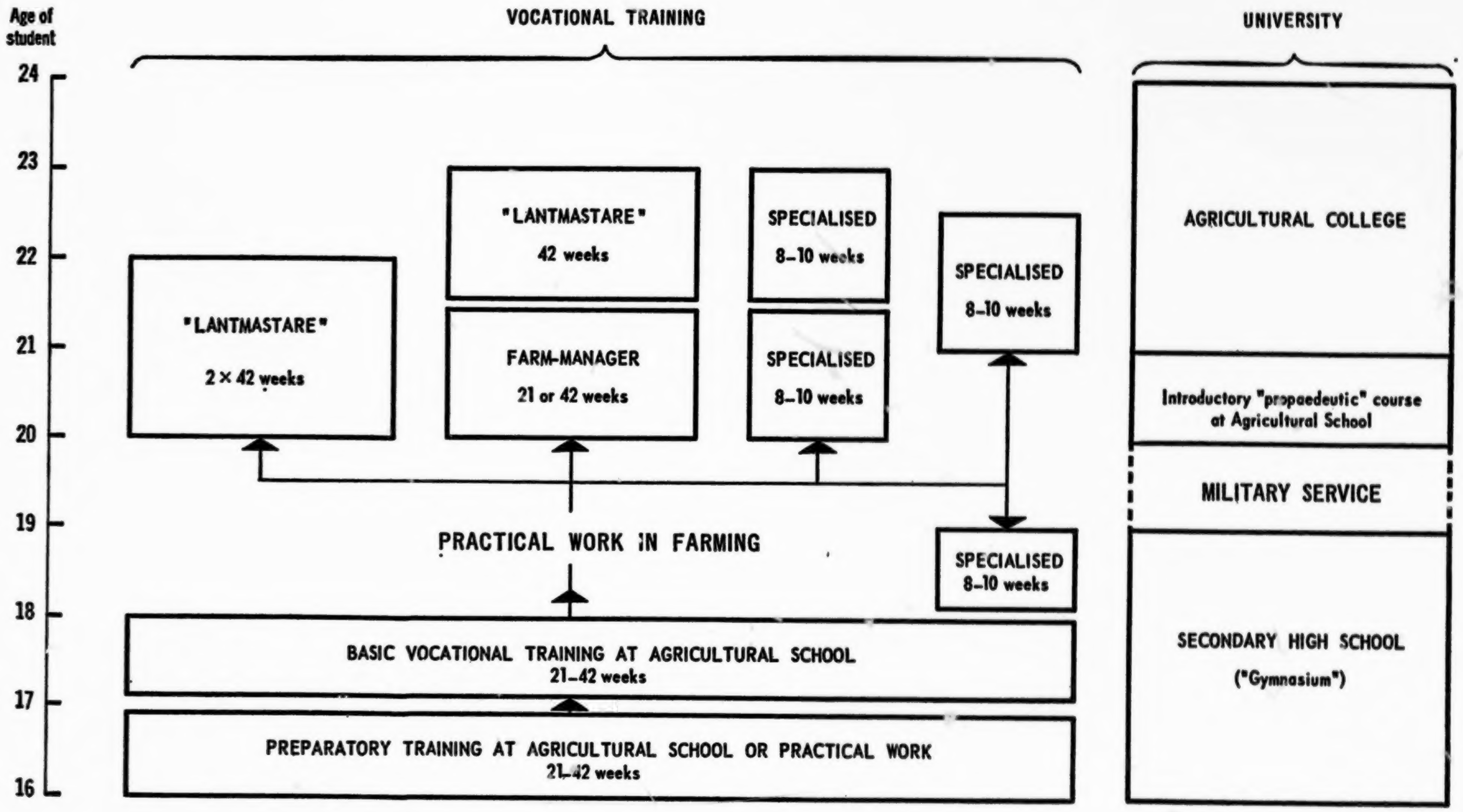

Age of student
24
23
22
21
20
19
18
17
16
VOCATIONAL TRAINING
UNIVERSITY
"LANTMASTARE" 2 × 42 weeks
"LANTMASTARE" 42 weeks
FARM-MANAGER 21 or 42 weeks
SPECIALISED 8–10 weeks
SPECIALISED 8–10 weeks
SPECIALISED 8–10 weeks
SPECIALISED 8–10 weeks
PRACTICAL WORK IN FARMING
BASIC VOCATIONAL TRAINING AT AGRICULTURAL SCHOOL 21–42 weeks
PREPARATORY TRAINING AT AGRICULTURAL SCHOOL OR PRACTICAL WORK 21–42 weeks
AGRICULTURAL COLLEGE
Introductory "propaedeutic" course at Agricultural School
MILITARY SERVICE
SECONDARY HIGH SCHOOL ("Gymnasium")

Chart 5. A more complete description of the agricultural education system in Sweden will be found in the OECD report in 1963 about Agricultural Vocational Training in Europe and North America[1]. But as some changes have been made in the organisation after the Swedish report for that project was delivered to OECD, a short description is needed in connection with the present study.

22. Everyone entering an agricultural school will have completed nine years within the compulsory school system, attending any of the different streams mentioned previously. Most of them will also have had one or more years of practical experience in agriculture, probably upon their fathers' farm. For those who have not had practical experience, there are *preparatory practical—theoretical courses* of 21 or 42 weeks length, during which pupils are trained on the school-farm in the different farm operations, and in addition receive theoretical training in the various agricultural subjects.

23. The next level is the *basic agricultural courses* of 21-42 weeks length. The shorter ones give theoretical training in conjunction with some practical instruction, and the longer courses include a larger proportion of practical training on the school-farm. This education is devoted to agricultural subjects and subjects of general education are dealt with very little. The object of the course is to give general, basic training to farmers-to-be, to farm employees, and to people employed by associations and firms related to agriculture (e.g. those supplying and servicing farmers, or handling and marketing farm produce).

24. Among the basic courses there is one of 10 weeks for experienced people. For admission to farm management courses and specialised advanced courses, candidates must have completed their basic vocational education. To facilitate the admission of candidates who for some reason did not undergo any basic vocational education when they were younger but who have thorough practical experience of farming, this shortened basic vocational course has been introduced. For entrance to it candidates must have had several years' practice in farming and be not younger than 25. In this course scholarships are more generous than in other courses. This course has also been of special interest for farmers who have increased the size of their farms by buying more land or who specialise their production and therefore are in need of a basic training in agriculture in order to make the most of their new opportunity.

25. In order to complete his education, the future farmer or qualified farm-worker should 'round off' either with a *specialised training course* or with a farm management course of 21-42 weeks' length. At present, four special training courses of more general interest are scheduled, each of 8-12 weeks, and in addition there are special-purpose training courses (e.g. poultry farming, training in yield-recording for animal husbandry), taking a limited number of pupils. The four special training courses of general interest are the following:

—Farm economics } (About 12 weeks each)
—Farm machinery

—Plant husbandry } (About 10 weeks each)
—Animal husbandry

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[1] *Agricultural Vocational Training in Europe and North America.* OECD Documentation in Agriculture and Food, 1963, No. 52.

26. The *farm management courses* are intended both for future farm operators and farm employees, and provide a training approximately equivalent to the total amount of knowledge imparted in the four specialised training courses mentioned above. In addition, the problem of work organisation is dealt with thoroughly. Instruction is theoretical; for admission two years' practice after completed basic vocational training course is required. Some assessment is made of the practical skill of pupils to serve as a basis of the awarding of marks. Formerly, foremen in agriculture were trained in two-year practical-theoretical courses, the theoretical instruction of which was approximately equivalent to that provided in the 21-week theoretical winter course. The new pattern represents a new departure in the matter of foreman training in agriculture.

27. The shorter manager courses are primarily intended for future farmers. The training is built up around the special training course in farm economics, but provides also deeper knowledge in the fields of plant husbandry and animal husbandry. This course will probably, at least to some extent, provide the training required for employment in farmers' organisations.

28. The forming of "lantmästare" (agricultural technicians) is the highest stage of education below university level. The title of "lantmästare" is acquired by passing an examination, and holders of "lantmästare" certificates are employed in the extension service as local advisors and assistants, in agricultural education as vocational instructors, and in organisations and firms related to agriculture. A large percentage of these qualified technicians devote themselves to practical farming as owner-occupiers or as land-agents for large estates: see Table 26.

29. For admission to a "lantmästare" course, a candidate must possess a good all-round formation, equivalent to that provided in 9 *g* by secondary school education (see paragraph 9), a vocational training equivalent to the one provided in the 42-week manager course, and a good practical knowledge of farming. Beside the one-year "lantmästare" course, which up to now was the only one, there is beginning with the school-year 1963/64 also a two year course, which constitutes an amalgamation of the 42-week manager course and the one-year "lantmästare" course. The training of "lantmästare" is concentrated in the Alnarp Institute in southern Sweden.

30. The relationship of *university-level training* in agriculture to the other stages and types of agricultural education is also shown in Chart 5. This training takes place in the Royal Agricultural College at Ultuna, near Uppsala. For admission, a candidate must have passed a higher certificate examination at a grammar school (three years in a "gymnasium", see paragraph 9) or must have reached a corresponding standard. The studies cover a period of five years. The first year is occupied by a introductory course at one of four selected agricultural schools. Half the time is devoted to theoretical instruction and half to practice on farms which are specially selected for the purpose and located in the neighbourhood of the school, and where students are regularly supervised by the instructors from the school. The remaining four years are devoted to university studies at Ultuna. Fairly far-reaching specialisation of studies in plant husbandry, farm economics, etc., is possible. Provided they pass examinations in the various subjects, students are awarded the degree of "Agronom". "Agronomer" and "lantmästare" who want to take up the profession of lecturer or

instructor have to undergo a 15-week course in pedagogic training arranged by the National Board of Agriculture.

31. Beside the different forms of agricultural education already mentioned, there is a *rural home economics course* given in special schools and dealing with problems related to the management of a rural household. The number of students, all female, is about 3,000 a year in courses of at least five months length. It is of interest to note that half of the participants come from urban areas. The courses are on the same level as the basic and specialised training courses at the agricultural schools. Instruction comprises all the subjects related to the management of rural homes. The greater part of the instruction is practical, and the schools have facilities for lessons in cooking, laundry, needlework and weaving. Rational work-planning and sound planning of purchases are subjects which have been given more attention in recent years. The time devoted to instruction in farming has been shortened lately, but such subjects as poultry-keeping are still taught and more time has been given to farm economics. It appears more and more important that pupils should discuss, on the basis of practical examples from family farms, the manner in which the labour input of family members should be divided between the farming side and the household in order to ensure the family as a whole the best possible total economic result.

32. The question of home economic training in general is under investigation by a Government committee appointed in 1963, but no-one can yet say to what extent the results of this enquiry will influence the agricultural home-economics schools. Because of this, they will not be considered in this study. However, it does seem likely that the agricultural schools will in the future themselves have to organise shorter courses of 5-10 weeks in order to give farmers' wifes some basic knowledge of the contribution that they can make to the efficient running of a farm.

3. SCHOOL ATTENDANCE RATES AND EDUCATIONAL ATTAINMENT OF THE AGRICULTURAL POPULATION

33. In Sweden as in other countries, the school attendance rate for the agricultural population has been lower than for people from urban areas. But it would be of little use for this study to discuss conditions that existed in the past. From the account of the organisation of Swedish education in general it will be seen that all young people have to complete nine years compulsory schooling and that the cost for their parents will be (about) the same wherever the family lives, since compulsory schooling is free. And even after these nine years, the student assistance scheme makes it possible for everyone who has the intellectual capacity to pursue his studies in any field he may choose. In these circumstances, it would be best now to concentrate the discussion upon agricultural education.

a) *The Number of Students undergoing Agricultural Education*

34. The number of students in different courses and at different levels is given for the last three years in Annex I. As an average for these three years we can use the following figures. Since the duration of training for nearly all these students is less than one year, we can consider these figures as showing the average annual output of trained students.

TABLE 6. ANNUAL NUMBER OF STUDENTS COMPLETING DIFFERENT LEVELS OF AGRICULTURAL EDUCATION

AVERAGE 1961/2-1963/4

LEVEL	NUMBER OF COURSES	NUMBER OF STUDENTS	
		ABSOLUTE	RATIOS[1]
Preparatory training	46	550	31
Basic vocational training	85	1,750	100
Specialised training	37	450	26
Farm management courses[2]	10	200	11
"Lantmästare"-course	1	70	4

1. Number of students in basic training = 100.
2. Excluding one-year head cowman courses.
Source: Annex I.

35. The number of students in the basic course is of special interest when calculating the attendance rate. The actual number of about 1,700-1,800 has been steady for a period of 10 years. The preparatory courses are comparatively new and show a slow but rather steady increase in number of participants. The same can be said of the specialised training courses and to some extent of the farm management courses.

36. In 1963 a questionnaire was distributed by the National Board of Agriculture among students who had attended a five-month basic course in 1955/56 and 1960/61 respectively. They were asked about their origin (if farmers' sons or not) and about their occupation immediately after the course and in 1963 respectively. The results are given in Table 7.

37. Due to the low response rate, the figures must be used carefully, but they do suggest that after a while nearly 1/3 of the students are employed in occupations *outside* agriculture. The tendency is for this figure to rise. In 1960/61 there was also a higher percentage of students from non-farm homes than there was in 1955/56; and a comparison of these sample results with the corresponding percentages for the whole population of students in basic courses in 1963/64 suggests that the proportion of students from non-farm families has risen further. The figures also show that among farmers' sons there are larger numbers in the larger farm-size-groups. That will mean a much higher attendance *rate* among sons of 'large' farmers than among sons of 'small' farmers (because numerically, small farmers are of much greater importance than large farmers: see Table 1).

b) *Educational Attainment in Agriculture*

38. An essential question is how many farmers and farm workers have had an agricultural education of at least 21 weeks or five months. No figures are at present available for the whole agricultural population, and it has not been possible to carry out even a sample survey in time for this present report. According to an estimation[1] of the educational level for all gainfully employed persons in agriculture, forestry and fishing based upon the Population census

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[1] Central bureau of Statistics: Interojunuder Söhningen 1960; Utbildning. (Folkräkningen 14.11.1964, mimeograph).

TABLE 7. RESULTS OF A QUESTIONNAIRE SENT IN 1963

YEAR OF COMPLETION OF COURSE	ORIGIN			OCCUPATIONS	
				IMMEDIATELY AFTER COURSE	
	FARMERS' SONS	NON-FARM FAMILIES	TOTAL NUMBER OF REPLIES	AGRICULTURE, FORESTRY	OTHER
1955/56-Number	573	87	660	544	115
Percentage	87	13	100	83	17
1960/61-Number	598	175	773	657	114
Percentage	77	23	100	85	15

1. 53 in military service or at school.
2. 159 in military service or at school.
Source: National Board of Agriculture (Leif Peterson).

of 1960, about 13 percent of these persons received some vocational education beyond primary school (university training included). It can be said, however, that only a very small percentage of the farm workers have received agricultural training in an agricultural school. Some data are available on the situation among farm operators, and the findings of two surveys will be quoted.

TABLE 8. FARMERS WITH VOCATIONAL EDUCATION
IN THE PROVINCE OF UPPSALA, 1965

SIZE-GROUP (HECTARES)		NUMBER OF FARMERS			
		WITH AGRICULTURAL SCHOOL			
ARABLE LAND	FOREST LAND	NUMBER	PERCENTAGE	WITHOUT AGRICULTURAL SCHOOL	TOTAL[1]
20-29	0	25	13.5	172	199
	1-49	60		351	416
	50-	6		48	57
30-49	0	66	22.9	240	307
	1-49	77		268	348
	50-	28		62	91
50-99	0	78	42.9	102	180
	1-49	54		83	138
	50-	41		44	85
Unpunched		2	...	21	24
Total		437	23.7	1,391	1,845

1. Including 17 punched cards that could not be classified by education.
Source: Forthcoming Study in Landbrukshögskolans meddelanden, Serie A, 1966, F. Petrini.

39. According to a small survey made by the Agricultural Economics Research Institute[2], (Jordbrukets Utredningsinstitut), out of 154 farmers who

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[2] Åke Sambergs: *Financial problems of newly-started farmers* Jordbrukets Utredningsinstitut. Medd. 1963: 6.

RMER STUDENTS IN BASIC AGRICULTURAL COURSES

OCCUPATIONS AT THE TIME OF QUESTIONNAIRE		INTENDED FUTURE OCCUPATIONS		DISTRIBUTION OF FARMERS' SONS BY SIZE OF FATHERS' FARM (HECTARES)			
RICULTURE, FORESTRY	OTHER	AGRICULTURE, FORESTRY	OTHER	10	11-20	21-50	51 AND OVER
476	184[1]	491	169	163	157	186	67
72	28	74	26	28	28	32	12
534	239[2]	593	178	154	177	195	72
69	31	77	23	26	29	33	12

became operators in 1958-1960 on farms in the size range of 2-100 hectares, only 26, or 17 per cent, had attended an agricultural school. Based upon a study of the diffusion of different agricultural innovations, F. Petrini in 1965 made a survey of the agricultural education of 1,845 operators of farms between 20 and 100 hectares in the province of Uppsala. An unpublished provisional analysis covering 1,828 of these operators is shown in Table 8.

40. It can be seen from the table that 23.7 per cent of all farmers on farms between 20 and 100 hectares in the country of Uppsala have received agricultural school training. There is a very strong relationship between such an education and the size of owner-operated farms. The percentage increases from 13.5 per cent in the group of 20 to 29 hectares to 22.9 per cent between 30 and 49 hectares and to 42.9 per cent between 50 and 99 hectares. There is a slight

TABLE 9. FARMERS WITH AND WITHOUT AGRICULTURAL EDUCATION IN FINLAND

FARM-SIZE HECTARES	1950			1959		
	NUMBER OF OWNER-OPERATORS			NUMBER OF OWNER-OPERATORS		
	WITH AN AGRICULTURAL EDUCATION	WITHOUT AN AGRICULTURAL EDUCATION	PER CENT WITH AN AGRICULTURAL EDUCATION	WITH AN AGRICULTURAL EDUCATION	WITHOUT AN AGRICULTURAL EDUCATION	PER CENT WITH AN AGRICULTURAL EDUCATION
2- 4.99	2,325	84,759	2.6	2,019	82,773	2.4
5- 9.99	3,368	76,386	4.2	3,632	87,764	4.0
10-14.99	2,711	32,831	7.6	3,237	37,806	7.9
15-19.99	1,711	12,436	12.1	2,145	13,918	13.3
20-24.99	1,486	6,031	19.8	1,583	6,038	20.8
25-29.99	981	3,093	24.1	1,092	2,885	27.5
30-49.99	1,711	3,253	34.5	1,823	2,977	38.0
50-99.99	589	562	51.2	662	474	58.3
100-	134	65	67.3	125	51	71.0
Total.........	15,016	219,416	6.4	16,318	234,686	6.5

Source: Finnish Board of Agriculture, Education Section.

tendency in the same direction for the forest area size-groups within each arable land size-group.

41. As agricultural educational conditions in the Scandinavian countries are similar in many respects, some Finnish and Norwegian figures are of interest. P.V. Fontell has given us the figures in Table 9.

42. In Norway an analysis of the agricultural statistics has given similar results. R. Celius gives the following figures.

TABLE 10. FARMERS WITH AND WITHOUT AGRICULTURAL EDUCATION IN NORWAY

FARMS AT SIZES LARGER THAN, HECTARES	NUMBER OF FARMS	FARMS OPERATED BY A PERSON WITH AGRICULTURAL EDUCATION	
		NUMBER	PER CENT
0.5	198,315	28,393	14.3
5.0	62,485	19,026	30.4
10.0	20,359	10,142	49.8
20.0	5,285	3,751	71.0

Source: R. Celius: Bönder og yrkesopplaering. Norsk Landbruk 1964: 22.

43. Even if the farms on average are smaller in those countries than in Sweden, the tendencies will be found to be the same. The smaller the farm, the lower is the percentage of farm-operators who have received agricultural training at a school. But it is essential to bear in mind that the number of small farms is very rapidly decreasing and this development therefore means a continuous increase in the percentage of farmers with an agricultural training.

44. A method that can be used to assess the average educational level of an occupation is to compare the number of students completing relevant courses with the estimated annual recruitment to that occupation. As will be discussed further on in the text (Chapter III : 2) the annual rate of recruitment of farmers during the decade 1950-1960 is estimated to have been about 2,500 and is thought to have remained relatively stable. During the last ten years the number of students who have completed basic courses has been on the average about 1,750 a year (Table 6). It has already been pointed out that about one third of them will probably not take up any occupation in agriculture. Further, of the students in the basic courses, at least 200 went on to farm-management courses. Of these it would be right to deduct 50 per cent who will take up other occupations than those of farmer or farm manager. We thus get a corrected figure for future farmers or employed farm managers of about (1,750 — 1,750/3 — 100) = 1,060 a year in basic agricultural courses. This means that among those who will take over farms in the 1960s about 40 per cent may have an agricultural education of at least five months. In the light of past experience, this figure seems somewhat high, but even if it were to be correct, considerable efforts must still be made to get *all* future farmers and farm employees to the agricultural schools.

4. NUMBER OF SCHOOLS AND TEACHING STAFF; ANNUAL COST OF AGRICULTURAL EDUCATION

45. The number of agricultural schools in Sweden is at present about 50. The schools are generally fairly small; thus the average number of pupils is only about 48 a school. The recruitment of pupils to these schools has been stable for a number of years though with a somewhat increasing tendency.

46. The number of teachers at the agricultural schools was 215 in 1965. 175 of them have passed "agronom" or other university-level examinations and 40 have passed the "lantmästare" examination or have received other suitable training for vocational teaching. In the same year teachers' salaries totalled Kronor 8.63 million of which the Government contributed 90 percent. The Government contributed Kronor 1.02 million towards the other costs of operation, this aid being equivalent to about one-third of the cost carried by the trustees. The Government contribution towards total current costs of agricultural education thus amounted to Kronor 8.79 million in 1965. The costs not covered by Government grants are covered by the trustees of the schools, generally the County Councils ("landstingskommun"). These costs vary much from one school to another, but can be estimated to amount to Kronor 3.0 million a year for salaries and other operating costs. The total operating costs (excluding rent and depreciation of buildings) covered by the Central Government and the Local Authorities thus amounts to about Kronor 12.0 million a year.

47. Building and capital costs can only be estimated very broadly. Using the cost of building the most recently completed schools as a basis, a figure of Kronor 2.5 million per school can be taken as standard cost at present prices, which gives a figure of about Kronor 125 million for 50 schools. The school farms also represent substantial assets. On account of the considerable differences in their size and location, their values vary much more than the values of the school buildings themselves. Taking their total areas, livestock, machinery, and buildings into consideration, the value of the school farms of all the agricultural schools in Sweden at present totals about Kronor 100 million. The total replacement value of the fixed assets at the agricultural schools can thus be estimated to about Kronor 225 million.

48. The annual Government grants towards new building work at the agricultural schools at present amount to Kronor 2.5 million. Government grants towards building generally amount to 50 per cent of the building cost, so the total capital actually invested by the Government and the Communes will thus probably amount to an average of Kronor 5 million a year. School farms are not included in these costs.

49. For certain educational equipment (e.g. farm machinery), an annual grant of Kronor 300,000 is available. The major part of the investments for other educational material is included in the operational costs already mentioned.

50. The costs of training teachers can be said to be included almost entirely in the costs of educating "lantmästare" and "agronomer". But teacher-training is completed by a 15-weeks pedagogical course under the supervision of the National Board of Agriculture. The number of students in this course is 30-45 annually and the annual cost is about Kronor 600,000. This sum also includes the cost of 5-10 in-service training courses (lasting 2 or 3 days to 1 week).

51. The annual expenditure of the Alnarps institute on "lantmästare"-training can be estimated at about Kronor 1.0 million for running costs. The value of investment in school buildings there is approximately Kronor 4 million and for teaching aids, Kronor 800,000. To these sums should be added the value of the school farm which, including land, buildings, the stock of cows, cattle and pigs, and machines and other equipment can be roughly estimated at Kronor 10 million.

52. As regards the cost of higher agricultural education ("agronomer") the following figures give the broad picture. Operating costs for the Agricultural College were Kronor 16.8 million in 1963/64. The cost of administration was Kronor 635,000 and the total salary bill amounts to 11.2 million Kronor. The total operating costs are expected to increase to Kronor 29.7 million by 1969/70, of which 15.9 million will be for salaries. During the period 1963/64 to 1969/70, the total amount of expenditure on investment is expected to be Kronor 69.0 million. Of this, building costs account for Kronor 51.5 million and equipment for Kronor 17.5 million (SOU 1965:11). It should be noted however that these figures for Ultuna include expenditure on agricultural (including horticultural) research in addition to higher education.

5. RELATIONSHIP BETWEEN FORMAL AGRICULTURAL EDUCATION AND OTHER FORMS OF AGRICULTURAL TRAINING

53. Besides formal agricultural education there are other forms of agricultural training, which are organised independently from the agricultural schools but which co-operate with them. Such forms are *Young Farmers' Clubs, apprenticeship schemes* and in-service training activities by *extension service agencies.*

54. Young Farmers' Clubs are organised on the lines of those in the United States. They belong to a central organisation which is independent but receives subsidies from the State. Under the supervision of travelling instructors, the members carry out work projects in the fields of plant husbandry or animal husbandry. The number of young people, up to 15-16 years of age, participating in these projects annually is about 15,000. Besides these projects they are also engaged in courses of different types. The teachers of the agricultural schools are used in these courses, which are sometimes held in the agricultural schools themselves. A closer connection between the Young Farmers' Clubs and the agricultural schools is desirable. The Young Farmers' Clubs are important for the vocational guidance of young people and can be of great help in encouraging bright young boys and girls to choose agriculture as their future occupation: even though the total active population in agriculture will decline in number, it is nevertheless desirable that this decline should not result in only the less able youngsters taking up agriculture as a career.

55. There are no real apprenticeship schemes for agricultural training in Sweden. Boys and girls from farmers' homes get their practical training on the home farm. The others can get it at the agricultural schools. Because of the high degree of mechanisation, however, it can be difficult to place young people from non-farm families in farming even after they have finished a course in an agricultural school. It therefore looks as if a closer contact between the schools and special farms in the neighbourhood will be needed in the future, in order to provide better practical training for this type of pupil. This kind of arrangement has already been tried in connection with the introductory courses with which the students of the Agricultural College of Ultuna commence their studies.

During the summer season, the participants in these courses receive practical training on different farms around the school and are visited 5-6 times by instructors from the school.

56. As in other countries, there are in Sweden special agencies which take part in the rationalisation programme for agriculture. On the regional level, there are primarily two agencies, working under the supervision of the National Board of Agriculture, which are of interest for this study, namely the County Agricultural Boards and the Country Agricultural Societies.

57. The County Agricultural Boards are responsible for the implementation of Government measures for the improvement of farm structure. These Boards make loans and grants to farmers buying additional farms or more farm-land in order to enlarge their holdings, or who want to invest in buildings or drainage. The work of the Boards includes advice to farmers on programme planning and economic calculations: they also give advice in connection with farm building or drainage projects, both ad hoc advice and in the form of short courses for small groups.

58. Beside the County Agricultural Boards, there is in every county a County Agricultural Society which is subsidised by the State and which has a staff of advisory officers for farm economics, plant husbandry, animal husbandry, farm machinery, home economics, and gardening. The County Agricultural Societies promote in different ways the efficiency of agriculture. To a great extent this is done by advisory work in the form of individual contacts, group contacts and also by the help of 'mass media' (e.g. pamphlets, postal circulars, radio, local daily press and national farming press).

59. Shorter courses (1 day-4 weeks) play an important role. The number of participants in such courses is more than 200,000 a year in about 7,000 courses, most of them one-day courses. The agricultural schools take part especially in the somewhat longer courses of 4-5 days up to 4 weeks. Some of them are located in schools, utilising both teachers, premises, and teaching equipment; others take place out in the regions and are run with the help of teachers from the schools. In Annex I figures are given of the extent to which the agricultural schools co-operate in the training given by the extension service. Close contact between the agricultural schools and the extension service has proved to be very important, particularly in the field of in-service training courses among farmers and farm employees.

60. State expenditure for the County Agricultural Boards amounts in the fiscal year 1965/66 to Kronor 21.5 million for staff and running costs, and for the County Agricultural Societies to Kronor 19.0 million. The expenditure for the National Board of Agriculture for the same purposes amounts to Kronor 6 million annually.

III. DRAWING UP A PROGRAMME

1. Definition of Principles; the Field of Study

61. In the previous chapters we have given a description of the present state of Swedish agriculture, including tendencies for future developments, and of

Swedish general and agricultural education, all of which provides a background for an investigation of the outlook for agricultural education up to 1980. In the next chapters, there will follow a forecast of the recruitment of farmers and farm employees; the need for agricultural training among those who enter agriculture will be discussed, and then a calculation will be made of the number of students at different levels, the number of schools and teachers, and investment in school buildings and teaching equipment. But first, some further premises must be stated.

62. The present time is not the most opportune for drawing up a programme. The present school system is relatively new and we have very little experience of the effect of the new organisation upon recruitment to agricultural training. The Swedish vocational training system as a whole is under review by a Government Committee and the result of this work will certainly have some influence also upon the future shape of agricultural education. But it is difficult to say to what extent this will happen. The national and regional organisation of the extension service is under reorganisation as a result of the work of another Government Committee. This will have some effect upon the in-service training of farmers. Although the situation is thus rather fluid we have chosen to base our programme upon the present situation. The whole study should be looked upon as a model which is true in given circumstances and valid for Swedish agriculture, but the intention is to offer at the same time some ideas to anyone who has to make such a study in some other country. If the circumstances are different from those in Sweden, it will be a simple matter to put new figures in the programme and to draw other conclusions. If a programme of this type is to be of any use, it will in any event have to be adjusted to continuously changing conditions.

63. The programme is drawn up on a national basis. The intention is that estimates similar to the ones in the national forecast and based upon the same principles shall later-on be drawn up for each of the 25 counties, by the regional education authorities against the background of local conditions. The global estimates for required enlargements of training facilities etc., presented in the following study will thus be better substantiated in the final national forecast built up from regional forecasts. But for basic principles of the study and for the models which this study will develop, that is of no practical importance.

64. The following discussion is entirely focussed on the agricultural sector. Of course, manpower changes in agriculture interact with manpower changes in other sectors. But even if the decrease of manpower in agriculture is relatively high, it can be seen from the distribution by age-group that most of the diminution is due to retirement at the upper end of the age scale. The implication for other sectors is primarily that they should absorb those farmers' sons and daughters in the younger age-groups who will not be required as permanent members of the agricultural labour force. In the Swedish labour-market, with a balance or even a shortage of manpower overall, this should cause no difficulties. In this study, we have therefore tried to estimate he development in agriculture itself in the light of the economic outlook for agriculture and to accept the results of these calculations as indicating realistically the likely future size of the labour force in agriculture. Forestry, gardening and home economics are in principle excluded from the study. Forestry education is the responsibility of another government office, and is primarily directed towards the category of hired workers and foremen in forestry, although to some extent, forestry education is given at the agricultural schools in their ordinary courses. This is espe-

cially true of economic programming for those farms that have significant areas of forest land. This form of forestry training, which is given in co-operation between agricultural and forest schools, is therefore included in the present study. Horticultural education is provided only on a small scale in Sweden, and the difficulties of securing a satisfactory basis for an estimate of recruitment to this rather specialised occupation are still greater than in the case of agriculture. To include gardening would probably not advance the development of a 'model', and so this occupation too has been excluded from our estimates.

65. It has already been said 'Chapter II: 2, that domestic science training in general is under investigation, and the role the agricultural home economics schools will play in the future is difficult to foresee. The agricultural subjects are given only little attention in their curricula, and the number of students from non-farm families is high. The majority of the students do not look for an agricultural occupation after school, and we have therefore found it both difficult and of little use to make any calculations in this particular part of the educational field.

66. To make an estimate of the future requirement of formal agricultural education meets with considerable difficulties. The marked development of our economy during the last decades has changed conditions for the individual to a large degree. Thus, for example, the progress of industrialisation has provided new sources of livelihood for many people. It is a known fact that the de-population of the thinly-populated areas is a reflection of that progress. The fact that labour requirements in agriculture have decreased continuously during the same period has accentuated this tendency still more. During the last hundred years, the population of Sweden has approximately doubled, and at the same time two million people have left agriculture to support themselves in other occupations.

67. What will the developments be during the next few decades? The answer to that question is of fundamental interest for an estimate of the requirement for agricultural education. But at the same time one should keep in mind that the question cannot be answered with any high degree of accuracy. This is due to the fact that the available information concerning the development during earlier stages does not present a true picture of the development up to now, and that the present rapid development can change conditions entirely in a very short time.

68. The forecast which is made in the following sections of this study of the number of people gainfully employed thus contains many uncertain factors. It should not be regarded as an expression of what is, in our opinion, likely to happen. On the contrary, the forecast shows what may happen if the assumptions we have made should prove correct even after the lapse of some time. If the conditions upon which our assumptions are based should change as a consequence of other developments, the conclusion of the estimates will naturally also have to be changed. It is our endeavour to develop and demonstrate, as far as possible, a methodology by which the estimated recruitment of agriculture can be delimited between certain maximum and minimum values.

2. EMPLOYMENT FORECASTS UP TO 1980

a) *Statistical sources and problems of comparability*

69. The following main sources of statistical material were used for the estimates:

i) The population censuses. Nation-wide material dating back to about 1750 is available.

ii) The censuses of agriculture. The inventories of agriculture, etc., were summaraised for the whole country from 1865 on; from 1927 on they became the 'Census of Agriculture'.

iii) The Central Bureau of Statistics issues annual labour statistics for agriculture (among other reports). These are derived from a sample survey and give a good picture of the trends but they are not suitable for estimates of actual numbers on farmers or holdings in any given year.

iv) The estimates made by the organisations of employers and of employees, based upon their internal statistics.

70. The following is a short account of those respects in which there are deficiencies in the sources mentioned. The account covers only sources (*i*) and (*ii*) and is based upon the conclusions and analyses made by Gulbrandsen[1].

71. *Differences Relating to Definitions. The censuses of agriculture* delimit the unit (the holding) on the basis of the land tax assessment. These can consequently be regarded as a source on the structure of holdings, defined in terms of prevailing legal and/or fiscal legislation.

> *Definition:* Every farm comprising more than 0.25 hectares of arable land which, having regard to its operation, constitutes one and the same enterprise and is operated by the same labour force, is considered to be a holding.

The population censuses: When the occupational classification is made, those persons who describe themselves as farm operators are sorted out from others.

> *Definition:* A person who for the greater part of his daily working hours is gainfully employed as owner-occupier or tenant of agricultural property is considered to be an operator in agriculture.

72. *The reasons why the number of holdings may be larger than the number of operators:*

i) The population censuses register natural persons only. Holdings on the other hand can be owned and operated by private or public juridical persons. Holdings owned by juridical persons will thus be represented by operators in the population censuses only if they are operated by tenants.

ii) The holding may be so small that it does not provide employment, for "... the greater part of ... daily working hours", and in that case the operator will be classified under some other occupation.

iii) One farmer may operate several physically distinct holdings, each with its own labour force.

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[1] Strukturomvadlingen i jordbruket, Stockholm, 1957.

73. *The reasons why the number of holdings may be smaller than the number of operators*:

- *i*) Two or more operators may operate the same holdings in partnership or as a family business.
- *ii*) One person may own a holding but operate only the forest part of it while some other person operates the agricultural part. There are then two persons who will declare themselves to be operators on the one holding.
- *iii*) One person who owns a holding but who spends the greater part of his daily working hours outside agriculture and who lets his land to a tenant may declare himself as an operator.

The author concludes: "In regard to definition, it is thus not clear which one will be the greater, the number of holdings or the number of operators: in fact, the extent to which the conditions described above exist will be decisive".

74. The following is a summary of the conclusions arrived at by Gulbrandsen regarding the censuses of agriculture and the population censuses as sources when estimating the structural development of agriculture.

- *i*) Both the differences relating to definitions and the procedure of classification lead to discrepancies in the numbers of operators and holdings.
- *ii*) The censuses of agriculture can be assumed to show the structural development with a certain time-lag, since they are based upon registers which do not always reflect the current situation.
- *iii*) The weakness shown by the population censuses for estimates of the number of operators is related to the necessarily rough classification between occupations of various kinds.
- *iv*) The population censuses indicate current structural changes in agriculture more rapidly than the censuses of agriculture.
- *v*) Because of their data on age-distributions, the population censuses constitute a useful forecasting tool. Both the retirement of old operators and the supply of young successors can be estimated with the help of such information.
- *vi*) More detailed comparisons have to be limited to relatively short-term calculations, as the comparability of data for longer periods is open to doubt on account of changes in the definitions used and tabulations made.

75. The volume of the statistical material is thus considerable. But as shown above, it suffers from such deficiencies that the changes in numbers of operators or holdings as well as in the distribution of holdings derived from it cannot be accepted unreservedly as indicating a structural change. The principles of estimation which are set out below must necessarily be based upon source material the figures from which have sometimes been adjusted somewhat subjectively. It is important to keep this in mind when considering the value for forecasting purposes of the estimating principles which we develop.

76. *General views on the development of the agricultural population as a background for the subsequent estimates.* The decrease of the total gainfully employed population was as given in Table 11 during the 1950s.

77. As is apparent from Table 11, the two sources do not agree on absolute numbers but they do both show the same proportionate fall in the course of a

TABLE 11. COMPARISON OF SOURCES OF MANPOWER DATA

<table>
<tr><th rowspan="2">SOURCE AND PARAMETER</th><th colspan="4">YEAR</th><th rowspan="2">DECREASE PER CENT DURING TEN YEARS</th></tr>
<tr><th colspan="2">1950</th><th colspan="2">1960</th></tr>
<tr><td><i>a</i>) Population Census [Para. 69 (<i>i</i>)]:
Number of persons gainfully employed in agriculture</td><td colspan="2">512,000</td><td colspan="2">331,000</td><td>35</td></tr>
<tr><td>Per cent of the total gainfully employed population</td><td colspan="2">16.5</td><td colspan="2">10.3</td><td></td></tr>
<tr><td></td><td>1952</td><td colspan="2">1957</td><td>1962</td><td></td></tr>
<tr><td><i>b</i>) Annual survey taken in June by the Central Bureau of Statistics [Para. 69 (<i>iii</i>)]
Number of persons gainfully employed in agriculture (except those temporarily employed)</td><td>734,000</td><td colspan="2">558,000</td><td>467,000</td><td>36</td></tr>
<tr><td>Decrease during the respective five-year periods</td><td colspan="2">24</td><td colspan="2">16</td><td></td></tr>
</table>

Sources:
a) Population Census, 1950, Volume VI, Table 1 and 1960, Volume IX, Table 3 (Folkräkningen 1950, band VI, tabell 1 och 1960, band IX, tabell 3).
b) Central Bureau of Statistics: The labour force in agriculture on 1st June every year from 1952 (Statistiska centralbyran: Arbetskraften i jordbruket fastställd ca 1 juni varje år from 1952).

decade. The reason can be that the peak-load periods in agriculture are increasingly being met by people who are either not classified as gainfully employed at all or classified as employed in other occupations.

78. The reports of the Central Bureau of Statistics on the labour force in agriculture on 1st June every year [Item (*b*) in the table] show the series below for the years 1952-1964.The figures comprise the operator, his family members to the extent that they were actually employed in agriculture at the time of the returns, and permanently hired labour. The figures show a continuous decline in all columns though with some year-to-year irregularities.

TABLE 12. FARM LABOUR FORCE: 1952-1964

YEAR	OPERATORS AND FAMILY MEMBERS	PERMANENTLY HIRED LABOUR	TOTAL
1952	651,910	81,770	733,680
1953	616,390	77,260	693,650
1954	574,880	66,300	641,180
1955	555,150	60,410	615,560
1956	515,620	54,250	569,870
1957	507,160	50,890	558,050
1958	496,940	47,500	544,440
1959	490,710	46,130	536,840
1960	475,670	41,730	517,400
1961	455,710	40,370	496,080
1962	429,330	38,050	467,380
1963	394,340	34,510	428,850
1964	360,210	33,130	393,340

Source: Central Bureau of Statistics.

79. A projection based upon the assumption of a constant percentage rate of decline per decennium, but using the figures from the population censuses, to 1970 and 1980 [Item (*a*) of Table II], shows the following figures:

TABLE 13. PROJECTION OF THE NUMBER OF FARM OPERATORS, 1950-1980

	1950	1960	1970	1980
Number of people gainfully employed in agriculture.	512,000	331,000	215,000	139,000
The agricultural population as a percentage of the total gainfully employed population	16.5	10.3	6.7	4.3

80. During the 1960s the number of people gainfully employed in agriculture thus declined strongly. Certain tendencies in the material cited above indicate, however, that in the early part of the period the decline was so heavy that a slackening of this development is very likely.

b) *Farmers*

Method 1: *An appraisal of the annual recruitment of farmers based upon the number of holdings.*

Discussion of general principles

81. We shall now consider a more specific method for estimating the annual number of 'recruits' to the population of farm operators. (We shall consider other members of the farm labour-force, and other persons who need an agricultural training, later.) For simplicity, we shall assume that the number of operators equals the number of holdings at any time.

82. The estimated number of holdings in 1980 can be arrived at by a projection of the numbers of holdings in 1951 and 1961. When estimating annual recruitment requirement for industries where only the estimated total number of gainfully employed people at the beginning and end of the projection period are known, the following formulae may be used:

$$\text{Expanding industry:} \quad K = \frac{P_0}{t} + \frac{P_1 - P_0}{u}$$

$$\text{Contracting industry:} \quad K = \frac{P_0}{t} - \frac{P_0 - P_1}{u}$$

where K = estimated annual recruitment;
P_0 = number of gainfully employed people at the beginning of the forecast period;
P_1 = number of gainfully employed people at the end of the forecast period;
u = the length of the forecast period;
t = the average period of gainful employment.

These formulae assume that the rate of expansion or contraction of the industry concerned will continue at the same absolute rate per annum. This is almost certainly an over-simplification, but it is a permissible first approximation[1].

Available forecasts

83. The recurrent censuses of agriculture provide material which shows the number of holdings in the various size-groups and the changes in numbers in each size-group. It is of importance *inter alia* for the government's activities for the improvement of agriculture that comparisons should be made from time to time between estimates of the expected development and what actually occurs. A Working Party of the Agricultural Policy Committee appointed in 1960 gives an account of such estimates in its report[2]. According to these estimates, the development up to 1976 of the number of holdings will, if the figures arrived at by the 1956 Structure and Population Survey are projected in five-year periods, be then as given in Table 14[3].

TABLE 14. PROJECTION OF THE NUMBER OF HOLDINGS, 1961-1976

SIZE-GROUP	YEAR			
	1961	1966	1971	1976
Over 2 hectares	232,959	209,971	190,238	173,191
Over 10 hectares	91,307	88,047	84,840	81,707

84. These figures may be compared with those prepared by the 1961 Structure and Population Survey[4]. Extrapolation of the number of farm units in 1961 to 1976 by different size-groups gives 171,806 holdings, and by different production-regions gives 173,249 holdings in 1976.

85. Further estimates, based upon the censuses of agriculture taken in 1956 and 1961, have been made by the National Board of Agriculture (Kungl. lantbruksstyrelsen). These estimates, summarised in Table 15, made by projecting the figures for each country and each size-group, show a decline that is somewhat more rapid than the one shown in Table 14.

86. As already mentioned, Gulbrandsen has drawn attention to the fact that the censuses of agriculture show the structural development with a certain time lag. In a contracting industry, and in the present context agriculture can be characterised as one, the time-lag means that the censuses of agriculture overestimate the number of holdings. As shown by some county studies[5], there is

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[1] This is discussed more fully in the third part of this report. "A Comparative Analysis of the Projection Methods used in the Pilot Studies."

[2] "Lantbrukets strukturutveckling", SOU 1964: 37.

[3] Cf. SOU 1964: 32, table 77.

[4] 1961-ars struktur- och befolkningsutredning (1961 Structure and Population Survey) Jordbrukets Utredningsinstitut 1964, Meddelande nr 5 och 6.

[5] "Landtbrukets strukturutveckling" SOU 1964: 37, page 146: "All the county studies mentioned show that in the counties the decline is expected to proceed still more rapidly".

reason to assume that the rate of decline is rather greater than that shown by successive censuses.

TABLE 15. PROJECTION OF THE NUMBER OF HOLDINGS FOR EACH COUNTY AND SIZE-GROUP FROM 1961 TO 1981

SIZE-GROUP	YEAR		
	1961	1976	1981
Over 2 hectares	232,920	161,132	145,086
Over 10 hectares	91,268	..	75,496

.. Not available.

Period of gainful employment

87. All the factors in the formula above are accounted for except t = period of gainful employment. Experience shows that accession to the status of holder in agriculture takes place relatively late in life. The son who is to take over the farm works at home until his father judges the time suitable to transfer the farm to him. From statistics of the number of operators in agriculture, based upon the population censuses taken in 1950 and 1960 (see Annex II), the number of new operators taking over farms in the various age-groups during the whole of the 50s can be estimated[1]. The results are shown below:

TABLE 16. ESTIMATED NUMBERS OF NEW OPERATORS IN VARIOUS AGE-GROUPS, 1950-1960

AGE-GROUP	HOLDINGS	
	OVER 2 HECTARES	OVER 10 HECTARES
-24 years	924	578
25-34 years	11,408	8,159
35-44 years	9,522	8,923
45-54 years	2,956	2,924

Source: Annex II.

88. The table shows that for holdings over 2 hectares, there are as many new operators over 35 years (12,478) as there are under (12,332). On holdings over 10 hectares there are 11,847 new operators over 35 and 8,737 under 35 years. Without exaggerating the need for accuracy, it seems realistic to assume an average age of taking-over of about 35 years. The same analysis of census data shows that many more operators retire over than under 65 years of age:

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[1] Analysis of inter-censal changes between age-groups can also be used for a direct demographic approach to manpower projections: see Method 2 below.

Table 17. ESTIMATED NUMBERS OF RETIREMENTS, 1950-1960

AGE-GROUP	HOLDINGS	
	OVER 2 HA	OVER 10 HA
Under 65	32,801	5,583
65 and over	83,281	27,497

Source: Annex II.

On the basis of these figures, one can estimate the average age of retirement as 65-70 years. It follows that the average period of gainful employment for farm operators is 30-35 years.

89. If we then take $t = 30$[1] and use this in the formula set out above, we will arrive at an estimate of the annual number of *persons who accede to the position of farm operator*. If all these persons are farmers' sons or other people already working in agriculture (but not as operators), then the estimate derived from the formula also gives an estimate of the annual *recruitment to the farm labour force* that is necessary in order to provide the calculated annual number of 'promotions' from worker to operator. To this number must be added the annual recruitment to the non-operator labour force needed to provide for replacement of losses for reasons other than promotion (e.g. retirement death, change to non-farm job). If we assume that the average working life of workers who do *not* become operators is 40 years, then we could use the basic formula and holdings data (because we are assuming 'one operator to one holding') twice, firstly with $t = 30$ to estimate the annual needs for potential operators (or actual operators), and secondly with $t = 40$ and 'career-worker' numbers, to estimate the number of supporting workers who do not become operators. Alternatively we could apply the formula once only with $t = 40$ but in this case we must use composite manpower built up from the following components:

i) numbers of holdings (assumed equal to the numbers of operators)
ii) numbers of *potential* operators
iii) numbers of '*career-workers*'.

We might estimate (*ii*) for the base-year as equal to about one-third of the number of operators (on the assumption that farmers' sons and other potential operators spend about 10 years waiting to become operators); and we could estimate (*iii*) for the base-years as the balance between (*ii*) and the total numbers of regular workers assisting farm operators.

90. It should be noted that it is very convenient that this method, applied to holdings data, gives an estimate of the annual number of young potential operators, because the training that *these* young persons should have must be appropriate to 'operatorship' and different from that appropriate for other workers. For illustrative purposes, we shall use the formula only to estimate annual recruitment of operators.

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[1] In choosing 30, allowance is made for the fact that some operators will leave agriculture for other sectors before retirement age.

Example 1: Annual recruitment to farms over 2 hectares:

Assumptions:

The number of operators is the same as the number of holdings.

The period of gainful employment for operators is 30 years. Forecast period starting 1961. Forecast period ending 1981

Formula for a contracting industry:

$$K = \frac{P_0}{t} - \frac{P_0 - P_1}{u}$$

P_0 = 233,000 according to Table 15
P_1 = 145,000 according to Table 15

$$\frac{233{,}000}{30} - \frac{233{,}000 - 145{,}000}{20} = 7{,}800 - 4{,}400 = 3{,}400$$

Example 2: Annual recruitment to farms over 10 hectares:

Assumptions and data as in Exemple 1.

$$\frac{91{,}000}{30} - \frac{91{,}000 - 75{,}000}{20} = 3{,}000 - 800 = 2{,}200$$

91. As already pointed out, this expression for K assumes a continuing annual decline at a constant absolute rate. The actual absolute rate of annual decline is more likely to diminish, so that the annual inflow of recruits will probably be greater than the estimate given by K. On the other hand, the projected numbers of holdings in 1981 are themselves probably too high, and the use of the above formula for K introduces some automatic compensation for this fact.

Method 2: *An appraisal of the annual recruitment of farmers based upon the population censuses taken in 1950 and 1960.*

Discussion of the general principles

92. The preceding calculations were based upon available statistics of the number of *holdings* and with the aid of a rather over-simplified though plausible method. The population censuses provide the possibility of making direct estimates of the future numbers of *persons* in agriculture (where such persons are, however, necessarily defined on the basis of census respondents' own declarations about what branch of industry they belong to and what kind of employment they have there).

93. The estimated total numbers of operators in 1970 and 1980 were arrived at by calculating separately the decennial increase (or decrease) in each 10-year age-group on the basis of the observed increase (or decrease) between 1950 and 1960. Population census data for 1950 are available separately for different farm-size-groups and an estimated analysis by size-group of data from the 1960 census was made[1]. The estimated changes between 1950 and 1960 were then computed separately for each size-group. The following formula was used:

$$g = \frac{b}{a}$$

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[1] The basis of these estimates and the adjustments that were made to ensure approximate comparability between the 1950 and 1960 figures are described in Annex V.

where a = the number of operators in a given age-group in 1950;
b = the number of operators in the next higher age-group in 1960;
g = the incremental (or decremental) coefficient.

94. For the projection, the numbers in each age-group of 1960 are then multiplied by the appropriate coefficient. The resulting figures are the estimated numbers in the next higher age-group (for each size-group) in 1970. The operation was then repeated, with the 1970 estimates as the starting point, to obtain projections for 1980. This method could not, however, be used for the "Under 25" age-group (since there was no earlier group from which coefficients could be calculated or to which they could be applied), and two assumptions were made in order to project the groups "Under 25" and "25-34":

i) the proportionate fall in the group "Under 25" observed in the decade 1950-1960 was assumed to occur in each of the following two decades; and
ii) the proportionate fall in the combined group "Under 35" (i.e. "Under 25" and "25-34") observed in the decade 1950-1960 was also assumed to occur in each of the following two decades.

The latter assumption may be expressed symbolically thus:

$$g = \frac{a+b}{c+d}$$

where a = Number of operators —24 years in 1960
b = Number of operators 25-34 years in 1960
c = Number of operators —24 years in 1950
d = Number of operators 25-34 years in 1950

This ratio (and the ratio for the "Under 25s") reflects the declining interest people have been taking in farming as an occupation.

95. These various coefficients, reflecting recruitment rates and retirement rates for each age group and each farm size, were calculated separately for each county. In order to give some indication of the general pattern of coefficients, the following table summarises the national average recruitment and retirement rates implied by the projections made in the manner just described. (The figures in a given column in the table are the coefficients by which to multiply the number of persons in the age-group *preceding* that indicated, in order to arrive at the number of persons in the designated age-group ten years later.) These figures have actually been derived from the 1970 projections and for illustrative purposes, coefficients have been shown for the age group "25-34" although in fact a different method—explained above—was used for projecting numbers in the groups "Under 25" and "25-34".

TABLE 18. NET RECRUITMENT AND RETIREMENT COEFFICIENTS

SIZE-GROUP (HA)	AGE-GROUP				
	25-34	35-44	45-54	55-64	65 and over
Over 50	11.78	1.442	1.050	0.723	0.255
21-50	12.90	1.727	1.152	0.772	0.254
11-20	9.81	1.604	1.108	0.822	0.355
2-10	4.68	0.966	0.754	0.689	0.429

The detailed results, on an aggregated national basis, are shown in Annex II.

96. In using the trend of the annual recruitments registered for 1950-1960, projected to 1970 and 1980, it must be stressed that the figures underestimate total recruitment, for two reasons :

i) recruits who enter the labour force after the first year but who leave before the tenth year have no effect on the numbers at the beginning and end of the decennium; and

ii) persons who are in the labour force in the first year but who retire in or before the last year will conceal the entry of a similar number of recruits who enter during the decennium and stay in the labour force at least until the last year. But although the figures are estimates of net recruitment[1], they can be regarded as indicating the absolute minimum requirement of new operators in the various size-groups.

97. Table 19 shows the total numbers of operators obtained by projection between 1950 and 1960 by means of Method 2.

TABLE 19. PROJECTION OF THE NUMBER OF OPERATORS 1950-1980

SIZE-GROUP	YEAR			
	1950	1960	1970	1980
Number of operators on farms over 2 hectares.......	284,000	193,000	129,000	83,000
Decline, per cent, during each ten-year period.......		32	33	36

98. Fuller details are shown in Annex II, from which it will be seen that average annual (net) recruitment during the period 1960-1980 for holdings of over 2 hectares will be about 1,400. The corresponding figure for holdings over 10 hectares can be deduced from Annex III and works out at about 1,300.

99. The annual recruitment of about 1,400 operators appears low. As a matter of fact the figure is so low that it would not even be sufficient to provide enough operators to manage the farms which are considered viable today and the increase in the proportion of old people in the agricultural labour force would moreover be further accelerated. The diagram in Annex IV shows the changes in the age distribution of operators as projected to the 70s, and the rapid rise in the proportion of older operators seems improbable.

100. This growing skewness in the age distribution is due in part to the assumption made in these projections that the decline in the rate of recruitment during the decade 1950-1960 would (*i*) continue during the following two decades, and (*ii*) occur in *all* size-groups of holding. Most of the decline in the number of holdings during the period 1950-1960 occurred among the smallest size-group, and there is reason to believe[2] that the main decline will continue among holdings *below*, rather than above 10 hectares. The alternative assump-

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[1] 'Net' here means net recruitment during a decennium into those age-groups that show an increase; it does not mean net of retirements from those age-groups that show a decrease.

[2] See "Recruitement to the smallest holdings", para. 108 below.

tion was therefore made that for holdings of over 10 hectares, recruitment would continue at the same absolute rate as in the decade 1950-1960, whilst the decline observed during that period in recruitment to smaller holdings would continue. The results of calculations made on this modified basis are shown in Annex III and the overall totals are shown in Table 20 below.

TABLE 20. PROJECTION OF THE NUMBER OF OPERATORS 1950-1980
ASSUMING CONSTANT RECRUITMENT
TO HOLDINGS OF OVER 10 HECTARES

SIZE GROUP	YEAR			
	1950	1960	1970	1980
Operators of farms over 2 hectares	284,000	193,000	135,000	99,000

101. As appears from Annex III, recruitment requirements will be about 2,100 (2,058) if the estimate is based upon the 'constant recruitment' assumption for operators of farms over 10 hectares, and if all farms over 2 hectares are included the figure will be 2,200 (2,149). As already pointed out, such estimates of recruitment requirements give *minimum figures, since the changes within the age-groups and size-groups do not appear.*

Comparison between the results of Method 1 and Method 2

102. An estimate of annual average recruitment based upon Method 1 and using the projected change in the number of *holdings* shown in Table 15 results in an annual average requirement up to 1980 of 2,200 persons on farms over 10 hectares, and if all farms over 2 hectares are included the number required will be 3,400. An estimate of the annual number of new operators based upon a demographic analysis of the *population* censuses (Method 2) results, when projecting the trend during the 50s directly, in 1,300 and 1,400 respectively. A development in the size and composition of the number of operators in line with these last-mentioned figures does not, however, appear likely, as has already been pointed out. Such a small annual inflow of operators would mean a markedly changed structure in the pattern of farm size and would also imply the employment of much more hired labour. With the use of a modified projection, Method 2 suggests an annual recruitment of 2,100 to farms over 10 hectares, and 2,200 if all farms over 2 hectares are included.

103. Now one must distinguish between the characteristics of a method and the characteristics of the basic data to which a method is applied. Method 1 could be applied to the overall net change in the total number of operators obtained through Method 2, and if the changes in the demographic structure of the estimated overall net change in the total number of operators used in Method 1 was known (which it was not) then Method 2 could have been applied to those data. Consequently we can at the moment only compare the results of Method 1 applied to 'its' data and Method 2 applied to 'its own' data. The following paragraphs explain the main reasons for the differences in the basic data, but given these differences, and recalling that the number of holdings exceeds the

number of operators (contrary to the assumption of equality made in using Method 1), and that Method 2 underestimates the true annual number of new entrants to each age group, we may conclude that the results of Method 1 represents the maximum annual requirements and that the results of Method 2 represent the minimum. We will use the results of the modified Method 2 in the remainder of this study.

The reasons for the difference between the number of holdings and the number of operators in 1960

104. According to Table 20 above, in 1960 the number of operators of farms over 2 hectares was 193,000, whereas the number of holdings was 233,000 (see Table 15). There is thus a difference of 40,000. The various reasons why there are differences between the number of holdings and the number of operators have already been discussed in Chapter III 2(*a*) above. In the present context the following factors are of particular importance.

105. It has already been mentioned that the owners of the smallest farms may draw their main living from some other form of gainful employment and that they may consequently be classified under some other occupation in the population census. On the other hand, their farm may still be registered as an individual holding. The change frequently takes place in stages: the operator leaves farming in the traditional sense by degrees, gradually taking more and more non-farm work outside his farm, and gradually becomes a non-farmer. (A characteristic feature of this development is that a farm ceases being a specialised dairy farm and becomes first a farm with few cows and finally a purely arable farm). One can generally assume that a small farm without dairy cows is an abandoned farm. But a farm of that type may nevertheless for various reasons still be registered as if it was an independent full-time holding.

106. According to the 1961 Census of Agriculture, the number of holdings without dairy cows amounted to 42,000, and 32,000 of them were below 10 hectares. One-third of the farms in the 2-5 hectares group had no dairy cows. There thus is reason to assume that a considerable part of the 32,000 holdings had actually ceased to be independent holdings.

107. The number of holdings over 10 hectares in 1961 was 91,268 (see Table 15), whereas the number of operators of holdings over 10 hectares in 1960 amounted to 92,228 (see Annex III). These comparisons show that the greater part of the differences are to be found among the smallest holdings, viz. those between 2 and 10 hectares. It has already been mentioned that the censuses of agriculture are based upon registers which are not always quite up to date and that their picture of the changing structure suffers from a certain time-lag. This time-lag in a stage of development which is characterised by strong decrease in the number of small holdings leads to an over-estimate of the number of farms in the smallest size-groups.

Recruitment to the smallest holdings

108. According to a decision of the Riksdag in 1947, price support and stabilisation for farm products in Sweden should be so organised that soundly operated "basic farms" (i.e. farms of 10-20 hectares of arable land) could attain full profitability. The extensive retirement of old operators that subse-

quently occurred in the smaller size-groups can be taken to indicate that as early as during the 50s the endeavour to create larger, viable farms had reached a stage characterised by non-recruitment to small holdings when their operators retired because of old age. A report[1] shows that the greater part of the abandoned holdings are to be found in the smallest size-groups. From 1956 to 1961, 25,170 holdings were abandoned, and 20,040 of them, or 80 per cent, were holdings smaller than 10 hectares. The same report also shows that the operation of the main part of the land which is abandoned is taken over by neighbouring farms. G.R. Ytterborn has reached the same conclusion in another study[2].

c) *Employees in agriculture*

109. The decrease of the number of people gainfully employed in agriculture was estimated with the aid of the population censuses. It thus appears that in the course of the 50s the percentage decreases in the numbers of persons in each of the main categories of the total farm labour force were as shown below:

Operators	36
'Cadre'[3] employees	18
Farm workers	35

110. According to the statistics of the Swedish Agricultural 'Cadre' Association (Svenska Lantbrukstjänstemannaförbundet) the number of members decreased from 1,719 to 1,181 (or 31 per cent) in the course of the ten-year period 1950-1960. A direct projection to 1980 based upon this percentage rate of decrease results in 562 cadre employees. The Association itself estimates the future requirement of cadre employes at about 800 with an annual recruitment requirement of about 60 persons, a figure which appears a bit high, however.

111. The number of unionist farm workers amounted to about 23,500 in 1962; about 4,000 are leaving and about 2,000 are entering the industry every year. The number of farm workers leaving certain sectors of the industry is thus very large. The net decrease is about 2,000 a year, and the Swedish Agricultural Workers' Union (Svenska Lantarbetareförbundet) estimates that a stabilisation will take place at a figure of about 15,000 farm workers who will probably not become operators and most of whom will generally leave agriculture before reaching the age of retirement: hence we can take 30 rather than 40 years as the average career length, and this gives an annual requirement of about 500 trained non-cadre farm workers. The Swedish Agricultural Employers' Association (Svenska Lantarbetsgivareföreningen) arrives at similar results in its estimates. The total annual requirement for cadre and workers is thus about 600 a year.

d) *Total number of farmers and employees estimated from productivity calculations (Method 3)*

An appraisal of the minimum number required of gainfully employed people, assuming unchanged total production

112. The preceding estimates of the numbers of operators and employees in agriculture were based upon projections of the developments observed in the

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[1] Lantbrukets strukturutveckling, SOU 1964: 37.

[2] FATIS Review 1965: 2

[3] Including some in ancillary industries.

decade 1950-1960. In certain respects the decrease during the 50s was however, so strong that a slackening of the rate appears inevitable. The *minimum* number of persons required in the labour force can nevertheless be verified approximately: assuming maximum production per man in crop and livestock husbandry, and assuming that total output will continue at about the present level, then the number of gainfully employed people required to produce that output can be estimated from the following formula:

$$L = \frac{A_1 + D_1}{50} + \frac{C_1}{100}$$

where L = total labour force (expressed in standard man-years)
A_1 = area of arable land at end of forecast period
D_1 = number of dairy cows in say 1980
C_1 = number (in cattle units)[1] of other livestock in say 1980.

113. In the official report on the possibility of making Swedish agriculture more efficient[2], optimum production programmes were estimated by means of linear programming, both in the long- and the short-run and for various regions. In the long-term programmes, the resource 'labour' was the only one fixed and the use of the other resources was given by the solutions. For a re-organised and enlarged one-man enterprise, the resource 'labour' was fixed at 3,000 man-hours. Using the best techniques known in 1960 and at the price levels prevailing that year, the optimal rate of land use was arrived at of 60 hectares per standard man-year in the lowlands of Sweden. For the forest areas, entirely different and rather varying figures were arrived at as a consequence of labour requirements in forestry. In view of this and of the fact that the input of labour by one man has in practice to be considerably less than 3,000 man-hours, the area of the optimal one-man enterprise can be estimated at approximately 50 hectares. This gives us the divisor for the first term on the right-hand side of the equation.

114. Calculations of labour requirements for specialised animal husbandry without crops were made at the Department of Production Economics at the Royal Agricultural College[3] (Institutionen för lantbrukets företagsekonomi). The labour requirements used were respectively 55, 50 and 45 man-hours per dairy cow per year for herds of 50, 200 and 400 cows. For a herd of 50 cows, that would imply a total of 2,750 man-hours a year. This size of herd is on the high side under present conditions in Sweden, but may be realistic in a long-term programme: labour requirements per cow can probably be brought down in the course of a fifteen-year period.

115. Labour requirements for other livestock were estimated on the basis of the number of livestock at the beginning of the 60s and with the application of the best production techniques known then for large herds in suitable buildings. According to the Data Manual for Operation Planning (Databok för driftsplanering)[4], if ideal production conditions exist then labour requirements are the following:

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[1] One cattle unit = 1 full-grown bovine animal, 2 young cattle or calves, 0.67 full grown horse, 1.33 colt or foal, 4 pigs, or 10 sheep.

[2] Hjelm: Det svenska lantbrukets effektiviseringsvägar, SOU 1963: 66.

[3] S. Norin and B. Johnsson: Lönsamhet och resursåtgång vid specialiserad djurskötsel. Lantbrukshögskolans meddelanden, Serie A, Nr. 12, Uppsala 1964.

[4] Lantbrukshögskolans meddelande, Serie B, Nr. 1, Uppsala 1963.

	Man-hours per year
Young cattle	10-18
Breeding pigs	35
Fat pigs	0.75
Sheep	8 (per ewe)

116. Assuming an improvement in production conditions (farm layout, buildings, etc.) so that the labour requirements used in the calculations for the *best* herds in the 60s can be regarded as an *average* for 1980, and also assuming that the percentage composition of the total number of livestock (dairy cattle excluded) will be about the same as now, then one standard man-year of labour will be needed for the care of about 100 cattle units (other than dairy cattle) in 1980. We now have the divisors for the remaining two terms of the equation. We shall next consider the basic data.

117. The following figures show the total arable area and the total number of dairy cows in Sweden in 1961 together with corresponding forecasts for 1980:

	1961	*1980*
Arable area ('000 ha)	3,295	2,500[1]
Dairy cows ('000 head)	1,155	800[2]
In addition there were in 1961:	('000 head)	
Horses	165	
Bulls and young stock	1,170	
Pigs	1,975	
Sheep	135	

In order to get comparable figures of the size of total livestock production and its development, the various kinds of animals were converted into cattle units[3]. The following figures[4] show the changes in the total number of cattle units (*including* dairy cows but *excluding* poultry and eggs) from 1959 to 1964.

Year	*'000 Cattle Units*
1959	2,720
1960	2,559
1961	2,611
1962	2,636
1963	2,529
1964	2,429

118. It will be observed that in spite of a strong decrease of the number of dairy cows, the total number of cattle units has remained fairly stable during the six-year period. The number of cattle for slaughter will decrease in the future on account of the shortage of calves, (itself a consequence of the decrease of the number of dairy cows). Consumption will probably shift towards other kinds of meat, such as mutton, pork, and broilers. It is impossible to give an accurate forecast of the likely development in the field of livestock production; on the whole, a decrease of one type of animal will probably be compensated by an

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[1] SOU 1964: 37, page 22, sub-section (*b*).

[2] Swedish Society of Animal Husbandry (Svensk Husdjursskötsel).

[3] See Footnote to paragraph 112.

[4] SOS Yordbruk och boskapsskötsel 1963 and SOS Statistical Yearbook of Agriculture 1965.

increase in other types so that the total number will remain unchanged. However, there are some reasons to expect that the total number of cattle units will decrease. For the sake of simplicity the number of cattle units has been assumed to decline to 2,000,000 in 1980.

119. The area of arable land is estimated to decrease to 2,500,000 hectares in 1980[1], and the number of cattle units (including dairy cows) is estimated to decrease from about 2,500,000 in 1963 to about 2,000,000 in 1980. Assuming that in 1980 one man is required for the operation of 50 hectares of farm land, and that one man is required for the care of 50 dairy cows, or for 100 cattle units of other livestock, the number of standard man-years can then be calculated as follows:

$$L = \frac{A_1 + D_1}{50} + \frac{C_1}{100}$$

then

$$\frac{2{,}500{,}000}{50} + \frac{800{,}000}{50} + \frac{1{,}200{,}000}{100};$$

$$50{,}000 + 16{,}000 + 12{,}000 = 78{,}000.$$

Thus based upon these assumptions the minimum number of regular workers (including operators) required in 1980 will be 78,000.

120. This figure of the minimum number of regular workers (including operators) in agriculture has to be corrected on account of the connection between agriculture and forestry in Sweden. In 1961, 73 per cent of all holdings over 2 hectares of farmland were 'composite farms' (i.e. farming combined with forestry). As explained below, about 18,000 standard man-years of forestry work have to be added to the minimum number of standard man-years in agriculture. The total number of standard man-years in agriculture plus forestry work done by people gainfully employed in agriculture thus amounts to 96,000. The minimum number of people (including operators) employed in agriculture in 1980 will therefore be 96,000.

121. The values used here may be regarded as a little extreme, but they do serve to underline that there is still scope for improvement in labour productivity in agriculture to the extent that capital is available. So complete a transformation as the one assumed in the last estimate, however, would necessitate very considerable investment, particularly in farm buildings. By way of comparison, with present work efficiency, estimates based upon data from the reports of the Central Bureau of Statistics on conditions on 1st June every year show that in 1960, in addition to family help, one man was required for about every 20 hectares of farmland and for about every 20 head of dairy cows.

Projection according to Method 3

122. A third estimate of the required rate of annual recruitment can be based upon a formula which is a modification of the one introduced for Method 1:

$$K = \frac{P_1}{t}$$

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[1] Compare SOU 1964: 37.

where K = estimated annual recruitment
P_1 = number of farmers in the terminal stock
t = the average period of gainful employment.

If we apply this formula to a projection of the *total* number of persons regularly engaged in agriculture (i.e. operators plus regular employees) then we should assume a period of gainful employment of 40 years[1]. The annual recruitment necessary to maintain about 78,000 would be 1,900 and for 96,000 gainfully employed people would be about 2,400. It has already been pointed out that these projections of the total labour force are based on the optimistic assumption that by 1980 today's *best* work standards will have become the *average*. It should nevertheless be noted that the attainment of such a level of labour productivity (even though this may well not occur as soon as 1980) will not mean that there will be no further improvement. Thus, in the (unspecified) long run, even the above figures for average annual recruitment will be too high.

123. In an agricultural industry with a relatively high work efficiency and with the probability of further growth in that efficiency, the ratio of employees to operators will necessarily change towards a greater number of employees for each operator. The share of work of the employees in production will, however, at least partly be done by sons working at home (who will ultimately take over the farms), and by fathers who have assigned their farms to their sons but who continue their work on the farm in partnership with their sons. The fact that the number of employees may increase affects the planning of education to some extent, though until now this possible development has not been considered to be so imminent that immediate steps should be taken. It should however be stressed that the problems of education in Swedish agriculture are still primarily ones of educating operators.

e) *Interaction with forestry manpower*

Forestry manpower

124. As already mentioned, there is a close connection between farm holdings and forestry in Sweden. In 1961, 7.5 million hectares, or about 68 percent of privately-owned forestland, were thus operated in combination with farms of at least 2 hectares of arable land[2].

125. The method of calculation, which is based upon production and performance, is frequently used for forecasts concerning labour requirements in forestry. Although agriculture is entirely independent of forestry in the matter of education, it may be of some interest to look at the likely development in the field of forestry.

126. The requirement of labour, i.e. of the number of regular workers in forestry, is calculated by means of the following formula:

$$L = \frac{0.27V}{210}$$

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[1] See paragraph 89.

[2] Kungl. lantbruksstyrelsen, Meddelanden, Serie C Rat. avd., Nr. 9. Strukturutvecklingen i jord- och skogsbruket (The Structural Development of Agriculture and Forestry), Solna 1965.

where L = Total labour requirement in standard man-years
V = Volume of felled timber in forest cubic metres
0.27 = Number of man-days per unit of felled timber
210 = Number of man-days per year

Changes in production volume and in relative labour requirements

127. The Working Party on Structural Problems of the Agricultural Policy Committee appointed in 1960[1] made estimates of labour requirements in forestry. The following account is a summary of how the estimates were arrived at.

128. According to the latest National Forest Survey (Riksskogstaxering), the volume[2] of annual growth is estimated at about 68 million m^{3}sk. At the beginning of the 60s, the annual fellings amounted to about 51 million m^{3}sk. Fellings are expected to increase in the course of the 60s. The Working Party made two alternative estimates of the volume to be felled in 1970. According to Alternative A it will be 58.4 million m^{3}sk and according to Alternative B 52.1 million m^{3}sk.

129. Relative labour requirements in forestry are decreasing. It is thus estimated that in the course of the ten-year period 1960-1970 the total labour requirement, including seeding or planting and care of the stands, will decrease by 25 per cent from 0.48 to 0.36 man-days for each m^{3}sk of felled timber.

130. In former forecasts 240 or 250 days worked were generally assumed for each regular worker. However, the change over to a five-day week necessitates a reduction of these figures. On the basis of experience, it has further been established that the number of 'lost days' due to sickness, bad weather and other unavoidable reasons (but excluding annual leave) for regular workers amounts to an average of 20 workdays a year[3]. In the tables to the revised edition of "Utvecklingen på skogsbrukets arbetsmarknad under 1960-talet". ("The development on the labour market in forestry during the 1960s"), the National Labour Market Board (Kungl. Arbetsmarknadsstyrelsen) assumes 200 days worked by each regular worker, and it is certainly advisable not to use a higher figure than 210 when converting total labour requirements measured in man-days to the annual equivalent in terms of the number of regular workers.

131. Assuming the same volume to be felled in 1980 as in 1970 but also that the labour requirement per unit will be brought down by rationalisation and mechanisation to the same extent as during the 60s, or by 25 per cent, from 0.36 man-days/m^{3}sk to 0.27 man-days/m^{3}sk (the number of effective working days per year being assumed to remain unchanged), the number of regular workers in forestry in 1980 will be between 67,000 and 75,000. V_{80} according to Alternative A is 58,000,000 and according to Alternative B it is 52,000,000. The number of regular workers (in standard man-years) in forestry in 1980

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[1] SOU 1964: 37.

[2] m^{3}sk = forest cubic metre, i.e. whole trunk including bark. 1 cubic metre = 35.44 cubic feet.

[3] Arbetskraft och utbildning inom skogsbruket (Labour and education in forestry), Promemoria, Kungl. skogsstyrelsen 1964.

according to Alternative A is:

$$L_{80} = \frac{0.27 \times 58{,}000{,}000}{210} = 75{,}000$$

The corresponding number according to Alternative B is:

$$L_{80} = \frac{0.27 \times 52{,}000{,}000}{210} = 67{,}000$$

The volume of forestry work available to the farming population

132. According to the estimates of the National Board of Private Forestry (Kungl. skogsstyrelsen), the total volume of work in forestry in 1965 amounted to 22 million man-days. Of this volume equal parts, or 11 million man-days, refer to large scale forestry and private forestry respectively. The volume of work is expected to decrease to 19 million man-days in 1975[1].

133. The labour force in private forestry consists mainly of farmers, and they alternate with the seasons between farming and forestry. In addition to this work in private forestry, this labour force did about 3.6 million workdays a year in *large-scale* forestry in the early 60s. This input of labour to large scale forestry is expected to decrease up to 1970 as follows: according to Alternative A to 1.9 million man-days a year, and according to Alternative B to 1 million man-days a year. The input of work by *farmers* to *private* forestry is expected to decline although the felling-volume of private forestry on the other hand is expected to increase more than that of large-scale forestry. After a period of 10-15 years it can be assumed as a rough estimate that about 25 per cent of the total volume of work in forestry will be available to the people gainfully employed as operators or as hired workers in agriculture. Thus it follows that of the minimum number of standard man-years in forestry in 1980 (viz. between 67,000 and 75,000), 25 per cent, or about 18,000, will be available to the labour employed in agriculture.

Forecast of total requirement of labour in agriculture and forestry in 1980

134. In conclusion, the total requirement of regular workers (including operators) in agriculture and forestry can now be worked out. The calculation is made by adding together the formulae for estimating the number of standard man-years in agriculture and in forestry respectively.

$$L = \frac{A_1+D_1}{50} + \frac{C_1}{100} + \frac{0.27V_1}{210}$$

$$\frac{2{,}500{,}000}{50} + \frac{800{,}000}{50} + \frac{1{,}200{,}000}{100} + \frac{(0.27)(58{,}000{,}000)}{210}$$

$$50{,}000 + 16{,}000 + 12{,}000 + 75{,}000 = 153{,}000.$$

Based upon the assumptions and conditions set out above, the minimum requirement of regular workers for agriculture and forestry in 1980 thus amounts to 153,000. About 57,000 of these have probably no connection with agriculture and are of no interest from the viewpoint of agricultural education.

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[1] Arbetskraft och utbildning inom skogsbruket. Kungl. skogsstyrelsen 1964.

135. Assuming an occupational period of 40 years, the requirement of annual recruitment to agriculture and forestry will be 3,800. As mentioned above some 1,400 of them should not be included in the estimates of the education requirements of agriculture.

f) *Ancillary branches*

The need for agriculturally trained persons in activities related to agriculture

136. As already pointed out, the number of people gainfully employed in agriculture is decreasing rapidly. The decrease may even go so far that they will constitute only 4 or 5 per cent of the total gainfully employed population. Broadly speaking, the consequence of the decrease will be that much of the work now done on farms will be carried out by industries, service trades, or marketing enterprises.

i) *Preceeding the stage of farm production* there is an extensive sector comprising advisers, engineering industries, seed, concentrates and fertiliser firms, repairs and maintenance workshops, and contractors of various kinds, etc. The number of people in this sector is increasing. Unfortunately, it is not possible to assemble any figures from official Swedish statistics showing the magnitude of this sector. In the United States it has been estimated that the number of people gainfully employed in agriculture (farmers and farm workers) is 7,000,000 and those employed in this 'pre-farm' sector (supplying and servicing farmers) 6,000,000[1].

ii) *After the stage of farm production* there are the food processing industry and the distribution firms. Here the official statistics offer figures of some interest[2]. In the food processing industry, the number of economically active population increased from 82,321 in 1950 to 98,167 in 1960, or by 19 per cent. During the same period the number of economically active population in the wholesale trade dealing with food increased from 27,764 to 31,855 or by nearly 15 per cent, and in the food retail trade from 68,807 to 110,105, or by 60 per cent.

137. These examples do not cover the whole field, but these groups of employees are the only ones covered by the official statistics. In the United States, food handling and processing farm produce comprises 10,000,000 persons as compared with 7,000,000 in agriculture as such[3].

138. The greater part of the actual work in these two sectors dealing respectively with farm inputs and farm outputs has no close relation to the physical operations carried out on farms: that work is highly specialised and an education entirely different from agricultural vocational training in the traditional sense is needed for it. This does not preclude the fact that there are a number of employees in these ancillary industries for whom a general knowledge and

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[1] *Agriculture is more than farming*, the Future Farmers' Supply Service, Virgina, USA.
[2] Folkräkningen 1950: VI Tables 1 and 20; 1960: IX, Table 4.
[3] See footnote 1 above.

understanding of the conditions of agricultural production can be of value, or for whom a thorough agricultural education equivalent at least to that of a well-trained farm operator is required.

139. An estimate of the number of trained persons needed by these ancillary industries is difficult to make and the precise nature of their educational requirements is no more easy to assess. The best basis for an estimate can at present be provided by the co-operative organisations, which in Sweden constitute both the first stage on the way from the farm to the consumer of by far the greater part of the total volume of farm products, and the last stage on the way to the farms of agricultural requisites.

140. The total number of employees in the farmers' co-operative organisations is about 40,000. The following account of the more important branches of the movement will give an idea of its requirements in the matter of agriculturally trained personnel.

141. In *the Swedish Farmers' Purchasing and Marketing Association* (Svenska Lantmännens Riksförbund), storing and marketing the grain produced by farmers, and selling fertilisers, concentrates, machines, and other requisites to farmers, it is estimated that the branch offices should have a staff of 150-200 employees who have received an agricultural education to enable them to negotiate efficiently with farmers. One-third of them should be "lantmästare". There are about 2,000 workers, and they should have at least some idea of what farming means. If the private firms in this sector were to stipulate the same requirements for their staffs, the figures mentioned would be doubled.

142. *The Swedish Dairies' Association* (Svenska Mejeriernas Riksförening) markets practically all milk produced in the country. The association employs milk testers, dairy husbandry instructors and others, up to a total of about 200, all of whom should have a sound agricultural training. In addition there are certainly some other staff members who should possess some basic knowledge of agricultural production, but their number cannot be fixed definitely.

143. *The Swedish Farmers' Meat Marketing Association* (Sveriges Slakteriförbund) is responsible for about 80 per cent of the national total number of slaughterings. The association employs "ombudsmän", i.e. legal and financial advisers, livestock agents, production advisers, etc., for whom a sound agricultural education is required. At present these people total about 125, but the number is rising continuously. There are also numbers of other workers (e.g. for livestock and meat transport) for whom some general knowledge of agriculture would be useful.

144. *The Federation of Swedish Rural Credit Societies* (Sveriges Jordbrukskasseförbund) employs a staff of about 1,100 at local and central credit societies. Some of them should have some general knowledge of agriculture. Today a third of them have received basic vocational education at agricultural schools. For the future, a basic education with a more commercial bias would be preferable, possibly completed by a short course in agriculture.

145. Adding up the above-mentioned figures, 500-600 people would require a thorough agricultural education; in addition there is an indefinite number requiring some short orientation course. With an allowance for the requirements of the trade associations not mentioned here and of the private sector, the figure should be doubled, arriving at 1,200.

146. Assuming a period of 40 years in gainful employment, the annual requirement according to Method 3 would amount to 30. Since the sector is expanding, and particularly the parts of it employing agriculturally trained people, the annual recruitment figure should be regarded as a minimum. However, it will probably not exceed 100 in the future.

147. In addition, there is the possible requirement of an active contribution from the agricultural schools in the matter of providing orientation on agriculture to other employees in these industries. That contribution might assume the form of special courses for the purpose, or firms might recruit their personnel from pupils who have embarked upon an agricultural education but later find they should have done something else, i.e. among pupils who have spent a year or so at an agricultural school.

148. However, the figures are relatively low, and there is no reason to make special provision for this kind of education. There are so many possibilities of error in the estimates of the annual recruitment of people gainfully employed in agriculture itself that the necessarily broad estimates for agriculture as such could be regarded as covering also the recruitment needs of the ancillary industries. At least, this could be said with regard to general agricultural education. When discussing the "lantmästare"-course, needs of the ancillary industries affect the picture in a quite different way.

g) *The requirement for people with higher agricultural education*

149. The discussion up to now has concerned people with an education corresponding to primary to 'middle secondary' levels[1]. But in agriculture there is an increasing need for people with higher education, either at university level or at non-graduate but post-secondary level. This latter category (which usually has had a good general secondary and technical or agricultural education of 2-4 years), is internationally known as "technicians" and in Sweden is called "lantmästare".

150. Although recruitment to agriculture as a whole is decreasing, the number of occupations within this that call for higher education is increasing, not only relatively but also in total. The process of rationalisation, stimulated and assisted by agencies set up by the State, or that receive grants from the State, needs people with a really good training. Further, the transformation of agriculture involves the formation of units and forms of production which raise the required level of agricultural education for an increasing number of farmers and employed farm managers. The category of technician is fairly new in agriculture as well as in the rest of the economy but it is rapidly increasing in importance. Thus the relation between graduates and technicians is changing from predominance of graduates to a clear predominance of technicians.

151. Unfortunately there are very few facts available for forecasting the requirements of these categories in the future. To get a better basis for planning the resources at the Agricultural College at Ultuna and the Institute at Alnarp (for "lantmästare"), the Swedish Government requested the Central Bureau of Statistics to make such a forecast, but the results of this will be available only in the Spring of 1966 and can thus be of no use for this study. We shall

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[1] See scheme on page 20 in *Agricultural Vocational Training in Europe and North America*, OECD Documentation in Agriculture and Food, 1963, No. 52.

therefore have to limit our consideration of this problem to rather general terms.

152. In the general field of forecasting future needs for qualified manpower, studies have been made to see if there is any relationship between the total number of persons engaged in manufacturing industry and the number of engineers and technicians, and to see if that relationship varies with the level of technical development of countries. Even within purely technical industries the relationships are generally rather weak, but nevertheless they do show a higher ratio between technicians and workers in countries with a relatively high level of technical development. For agriculture, as for other activities with varying conditions of production, it would be much more difficult to find any clear relationships or tendencies. Moreover, the figures of this ratio for Sweden would be true at the present moment, but it is difficult to decide if they would be the right values or should perhaps be higher in the future.

153. Before discussing the specifically agricultural problem further it might be useful to look at some figures for the industrial sector. In a Swedish report to OECD, a forecast of the future need for engineers was made by the National Labour Market Board. The numbers of civil engineers (graduates) and engineers with a basic secondary school education (technicians) is shown in relation to the total number of active persons in industry for the years 1960-1980 below:

TABLE 21. ACTUAL AND PROJECTED NUMBERS OF ENGINEERS AND TOTAL INDUSTRIAL LABOUR FORCE, 1960-1980

YEAR	CIVIL ENGINEERS	ENGINEERS WITH A SECONDARY EDUCATION	TOTAL ENGINEERS	NUMBER OF ACTIVE PERSONS IN THE INDUSTRIAL LABOUR FORCE	NUMBER OF ENGINEERS PER 100 ACTIVE PERSONS
1960	9,300	16,500	25,800	1,104,000	2.3
1965	12,700	24,100	36,800	1,164,000	3.1
1970	17,700	33,400	51,100	1,186,000	4.3
1975	22,700	43,100	65,800	1,181,000	5.6
1980	26,600	53,300	79,900	1,155,000	6.9

Source: Educational Policy and Planning in Sweden. A Swedish Contribution to the OECD programme on Educational Investment and Planning (EIP), Ministry of Education, January 1964.

154. If the figures can be regarded as reasonably true and as applicable also to agriculture, and assuming a total active population in agriculture of (say)[1]

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[1] This figure is made up as follows:

CATEGORY	'000
Operators	100
Potential operators	30
Others	20
Total	150

150,000 in 1980, we should in 1980 need

$$\frac{7 \times 150{,}000}{100} = 10{,}500$$

graduates and technicians and the ratio between them would be about 1:2. If we put the period of gainful employment as 40 years, then annual recruitment would be 10,500/40 = 260, according to the formula in paragraph 122, or about 90 graduates and 170 "lantmästare". The estimates assume that the number of gainfully employed agricultural graduates and technicians will stabilise at 10,500, which is not true. If a correction is made for an expanding industry as in Chapter III 2 (*b*), the annual rate of recruitment would be larger but in order to avoid over-estimation we have used the terminal rate formula.

The number of persons with higher education: Graduates

155. The present employment of agricultural graduates can be seen from the following figures for 1964:

TABLE 22. EMPLOYMENT OF AGRICULTURAL GRADUATES IN 1964

OCCUPATION	PERCENTAGE OF TOTAL STOCK OF EMPLOYED AGRICULTURAL GRADUATES
Advisory work	24
Research and experimentation	23
Teaching (all levels)	21
Farmers' co-operatives	10
Other private enterprises	11
Farm managers or operators	4
Miscellaneous	7
Total	100

Source: Royal Agricultural College, Uppsala.

156. The future demand for agricultural graduates is dependent on two basic factors, namely the need for replacements and the need for expansion. As regards the former, besides studies of the age distribution of the present stock of graduates in employment, an investigation should be made of whether there are any sectors of this labour market where numbers may decrease and where in consequence replacement needs may be nil, or less than those suggested by a study of the age distribution. Further, individual replacements may need a type of training (or a level of qualification) different from that of the person being replaced. For example, before the reorganisation in 1932 of the curriculum at the Agricultural College, the duration of training was shorter than at present and some of the earlier "graduates" would now be classified as "technicians". Some agricultural graduates will be replaced by graduates in commercial subjects, when the 'market' for their recruitment has been established and the necessary contacts have been made.

157. On the other hand, there is also a need for expansion. Firstly, there is a shortage of graduates with training in natural sciences in Sweden and some

agricultural graduates may be employed in the general field of natural science. Secondly, on account of the increased specialisation in different fields in the present training of agricultural graduates, there seem to be several new employment possibilities outside the traditional labour market for such graduates. No definite tendencies are, however, discernable yet. An official Committee is working on long term agricultural policy in Sweden and it is expected that in the near future guidelines for the agricultural administration and the general organisation of agriculture will be given. The expansion in the employment of agricultural graduates seems likely to be accounted for largely by the rationalisation of, and research in agriculture. There may also be an increase in the numbers of advisory staff, of officials in the co-operative movement and of persons working in connection with the manufacture and distribution of agricultural requisites and in the processing industry.

158. As regards the socio-economic origin of students to the Agricultural College, it is of interest to note that two-thirds of those who have graduated between 1932 and 1955 were recruited from the agricultural sector[1]. The fathers of these graduates were either farmers (only one was a farm worker) or teachers of agriculture or otherwise working in connection with agriculture. The agricultural regions are slightly over-represented. It is also interesting to note that the distance to a college is influential. This is particularly evident in the southern-most County, Malmöhus, where the recruitment of students has decreased from 13.0 per cent of all agricultural graduates before 1932 to 9.4 per cent between 1932 and 1952. In 1932 higher education in that County ceased and university level training in agriculture was concentrated in the Royal College, located at Uppsala in Central Sweden.

159. The latest official forecast for agricultural graduates was made in 1960[2]. There then were living 1,282 graduates from agricultural colleges, and these represented 1.9 per cent of the total stock of graduates in Sweden. The need was calculated on the basis of considerations of the same type as those mentioned above. The replacement need was calculated on the basis of the age distribution and known death rates, and the expansion need was postulated in the light of agreed views about desirable future developments.

TABLE 23. THE DEMAND FOR AGRICULTURAL GRADUATES, 1965, 1970 AND 1975

PARAMETER	1960	1965	1970	1975
Total demand	(1,282)	1,320	1,410	1,500
Calculated number of survivors below 65 years, who graduated in 1960 or earlier	1,282	1,068	843	654
Cumulative replacement need	—	214	439	628
Cumulative expansion need	—	38	128	218
Cumulative total increment	—	252	567	846
Relative increase of total demand (1960 = 100)	100	103	110	117

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[1] Arbetsmarknadsinformation (Labour Market information) S 4/1957. Arbetsmarknadsstyrelsen.

[2] SOU 1962: 55. Tendenserna på akademikernas arbetsmarknad fram till mitten av 1970-talet (Trends on the labour market for academic people).

160. The supply was calculated independently on the basis of examination results at the Agricultural College. The original calculations have, however, been slightly modified by using later information: new admissions, students on roll and annual output up till 1964/65 are actual figures. For the last five years during the 60's, the total number of available places was assumed to increase by five places per year. After 1964/65 the total number on roll was calculated as equal to the number of new admissions during the last five years plus 20 per cent of the number of new admissions five years earlier to cover those students who need an extra year of study. The expected number of graduations was estimated as equal to 80 per cent of new admissions five years previously plus 20 per cent of new admissions six years previously; 95 per cent of this expected number were assumed actually to be awarded degrees. After 1964/65, 15 per cent of the number of graduates are assumed to be women. (Table 24).

TABLE 24. ACTUAL AND FORECAST NUMBERS OF AGRICULTURAL GRADUATES 1960/61-1974/75[1]

YEAR	NEW ADMISSIONS[2]	STUDENTS ON ROLL[3]	EXPECTED OUTPUT[4]	GRADUATES[5]			
				ANNUAL OUTPUT		CUMULATIVE OUTPUT	
				TOTAL	WOMEN[6]	TOTAL	WOMEN[6]
1960/61	44	215	33	25	—	25	—
1961/62	46	223	40	39	2	64	2
1962/63[7]	59	243	37	55	2	119	4
1963/64	65	268	40	40	3	159	7
1964/65	70	293	45	29	3	188	10
1965/66	75	324	44	42	6	230	16
1966/67	80	358	46	44	7	274	23
1967/68	85	387	56	53	8	327	31
1968/69	90	413	64	61	9	388	40
1969/70	95	439	69	66	10	454	50
1970/71	100	465	74	70	11	524	61
1971/72	100	486	79	75	11	599	72
1972/73	100	502	84	80	12	679	84
1973/74	100	513	89	85	13	764	97
1974/75	100	519	94	89	13	853	110

1. Actual figures up to 1964/65.
2. In previous years, admissions were: 1954/55 : 38
1955/56 : 31
1956/57 : 43
1957/58 : 35
1958/59 : 41
1959/60 : 46
3. Numbers on roll = New admissions during current year *plus* preceding four years *plus* 20% of new admissions five years previously.
4. Expected output = 80% of new admissions five years previously *plus* 20% of new admissions six years previously.
5. Graduations assumed to be 95% of expected output.
6. Women assumed to be 15% of total graduations.
7. From 1962/63 onwards, new admissions include horticultural students.

161. The figures on graduation obtained in this way were added to the number of graduates still active and of working age (Table 25), and a comparison between the supply and demand can thus be made: a probable balance can be seen. Although the number of agricultural graduates as a percentage of

all graduates decreases during the period from 1.5 in 1965 to 0.8 in 1975, the absolute number of graduates increases by 20 per cent during that period.

162. There may nevertheless be a future shortage of agricultural graduates although this is not shown in Table 25. In a forecast made in 1946 for the need of agricultural graduates in 1955, the number given turned out to be 179 persons less than the actual number of graduates employed in that same year: there was thus an underestimation of 19 per cent. On the other hand, given the assumptions used in Table 24, the annual output of graduates will stabilise at about 100. Of these, it is expected that about 20 will have specialised in horticulture.

TABLE 25. THE SUPPLY OF AND DEMAND FOR AGRICULTURAL GRADUATES, 1965, 1970 AND 1975

PARAMETER	1965		1970		1975	
	TOTAL	WOMEN	TOTAL	WOMEN	TOTAL	WOMEN
Survivors below 65 years who graduated in 1960 or earlier	1,068	26	843	26	654	26
New graduates since 1960	188	10	454	50	853	110
Total supply	1,256	36	1,297	76	1,507	136
Total demand	1,320	..	1,410	..	1,500	..
Shortage	−64	..	−113	..	+7	..

. . Not available.

The requirement of technicians in agriculture and ancillary branches

163. Agricultural technicians will be found as farmers and employed farm managers (on larger farms), on the staff of industrial firms (Cf. Chapter III 2 (*f*) about ancillary industries) and farmers' co-operatives and as government servants, e.g. as advisers and teachers. Since 1933 "lantmästare" have obtained their qualifications by passing the examination of the Institute at Alnarp. A summary of their occupations can be found in statistics put together by the Swedish Agricultural Technicians' Association (Sveriges Lantmästareförbund). The occupations of the 491 "lantmästare" who received their certificates during 1950-1960 (nearly all of those who attended the courses) were in 1964 the following:

TABLE 26. EMPLOYMENT OF AGRICULTURAL TECHNICIANS 1964

OCCUPATION	PERCENTAGE OF TOTAL STOCK OF EMPLOYED AGRICULTURAL TECHNICIANS
Farm operators:	
Owners or tenants	34
Hired managers	25
Industrial firms and farmers' co-operatives	23
Government service	11
Miscellaneous	7
Total	100

. . *Source:* Sveriges Lantmästare förbund.

Employment of technicians in co-operatives, ancillary industry and government service has increased their relative share of the total compared with earlier studies.

164. In a survey made in 1964 by the Central Bureau of Statistics[1] about the labour market, a shortage of employees with higher secondary education in agriculture ("lantmästare") was reported. The possibilities for recruiting people with this education were less than the year before, and the demand for agricultural technicians is expected to increase in the future. Against this background, the number of students in the "lantmästare"-course has been increased from 72 in 1963 and 1964 to 120 in 1965.

165. In a discussion about the number of occupations where there is a demand for higher secondary education in agriculture, it is very difficult to state the number of future farmers and farm managers who will look for education at this level. During the period 1950-1960 it was about 30 a year. But all those who applied for admission to the course were not admitted. In 1964, the number of applicants to the course for agricultural technicians was three times the number of those admitted. Thus this figures is much too low, even as an absolute minimum.

166. If we make a rough assumption that in every farm larger than 50 hectares there should be one agricultural technician, then according to the calculations in Annex II we will in 1980 have about 4,000. If we put the period of gainful employment as 30 years and again use the terminal rate formula, it will give us a figure of about 130 a year, although, given that the demand for technicians on farms should increase, this figure is an underestimate. The assumption of one qualified technician on every farm of over 50 hectares is, however, itself probably overambitious, and the resulting estimate of about 130 recruits a year is better regarded as a maximum.

167. Of the total number who passed their examination in 1950-1960, more than 100 went to commercial and industrial firms, associations and co-operatives connected with agriculture. That is equivalent to 10-15 a year. Bearing in mind that the tendency for this category is that the requirement is increasing, and recalling the discussion in Chapter III 2 (*f*) we will use 15-20 for the present exercise.

168. Within the Government sector there are now 600-700 posts for which technicians are needed. Some of them are not agricultural technicians (e.g. those posts concerned with forestry and general technology). The organisation of part of the agricultural administration (viz. the land improvement and advisory services) is now being reviewed and it is difficult to make any definite prognostications. But the tendency is for an increased requirement of agricultural technicians, and as a conservative estimate we can assume that the annual recruitment will be 10-15.

169. We may summarise as follows. For the ancillary industries and services (including Government services), we have found the expected annual rate of recruitment to be about $20+15 = 35$ a year. These sectors correspond to 1/3 of the total number of agricultural technicians who obtained their qualifications during the last decade, and if we assume the same proportion for 1980, this will

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[1] Forecasting information. Medd. PI 1965: 1. Central Bureau of Statistics, Stockholm.

give us a total number of about 100 as a minimum figure. As a maximum figure we will use 130 future farmers and employed farm managers a year (§ 166), which together with about 30 for other sectors (§ 146) will give us 160 a year. The figure thus lies between 100 and 160; we shall assume 130. It is of interest to note that, compared with the figures given in the discussion of the graduate/technician ratio in para 154, the present estimates give a ratio of 80:130 or 1:1.6.

h) *Total recruitment at different levels*

170. The recruitment requirements of agriculture have been estimated with the help of statistics of the structural development and of statistics of the number of gainfully employed people. In order to test the plausibility of the assumptions, the minimum number of man-years has been calculated with the aid of estimates of production and unit labour requirements. Finally the total minimum number of man-years in agriculture and forestry were projected to 1980, assuming unchanged production.

171. The estimates can be summarised as follows:

An appraisal of the annual recruitment of farmers based upon the number of holdings (*Method 1*) (*para. 90*)	2,200-3,400
An appraisal of the annual recruitment of operators based upon the population censuses (*Method 2*) *para. 98*	1,300-1,400
(*Method 2*) *para. 101*	2,100-2,200
Annual recruitment of employees in agriculture, (*para. 111*)	500
Total number of farmers and employees from productivity calculation (*Method 3*) (*para. 122*) —Before adjustment for forestry	1,900
After adjustment for forestry	2,400
The annual recruitment of people to agriculture and forestry (*para. 135*)	3,800
Ancillary activities (*para. 146*)	30-100
Annual recruitment of people with a higher agricultural education Graduates ("agronomer") (*para. 162*)	80
Agricultural technicians ("lantmästare") (*para. 169*)	130

These various figures suggest that the 'best estimate' lies between the following limits:

	Minimum	*Maximum*
Farm operators	1,300	3,400
Other farm labour	500	500
	1,800	3,900
Ancillary activities	30	100
Graduates and technicians	210	210
Total	2,040	4,210

There is, however, some overlapping between these categories of manpower, and for the subsequent discussion we shall use an overall estimate of 3,000 per year.

3. TRANSFORMATION OF MANPOWER NEEDS INTO TRAINING NEEDS

a) *Target educational levels*

172. The next step in this study will be to state the vocational training required for the different categories employed directly or indirectly in agriculture. First, some assumptions must be made. The development in agriculture of larger and more efficient production units will increase continuously the demand for better general and vocational training, especially among farm operators but also among farm workers. Each farmer will in the future have had a general training during nine years in the new primary and lower secondary school. Some of them (how many cannot be foreseen now), will even have had two or more years of rather general education in "fackskolor" (continuation schools) or "gymnasia". This means that students in the agricultural vocational schools will have varying knowledge of general and scientific subjects and this fact underlines the need for 'flexibility' in the training given by these schools.

173. There will also need to be an emphasis in the training on receptivity to change. This implies that farmers will have to be trained to identify and solve their own problems. Thus theoretical aspects cannot be neglected in the applied fields. The agricultural adjustment problem as a whole will have to be explained, as well as how the Swedish economy functions. Economic calculations will be of the utmost importance in the syllabus. Techniques for collecting and analysing information must be taught. Basic goals for the farm and for the farmer's family will have to be analysed, and alternative means for reaching a particular goal will have to be demonstrated.

174. If we consider the real needs of agricultural training, we may say first that all categories of people employed in agriculture should have had practical training to enable them to do the work expected of them on the farm. Up to now, this practical training has to a large extent taken place on the home farm, but—as has already been pointed out—this training will have to be provided to a larger extent in the future by the schools.

175. Theoretical training is at present provided primarily by means of basic vocational courses and of advanced courses with a general bias (farm managers' courses) or of special training courses (e.g. farm economics). The farmer should have received a theoretical agricultural formation equivalent at least to the one provided by the basic vocational training courses; he should preferably also have participated in some of the longer advanced training courses. According to some studies, sound theoretical general knowledge is of vital importance for the success of a farmer, and it must thus be considered right and proper that young farmers-to-be should choose one of the theoretical sides of secondary school education. It may well be seriously considered whether theoretical subjects of a general nature should not be re-introduced in agricultural vocational training. The "fackskola" has changed the picture in this respect entirely. An agricultural education, directly linked with secondary school education, and organised on the same principles as are accepted, for instance, for technical continuation school education, might well be an attractive alternative to the other streams of continuation school education.

176. The number of hired workers may increase in the future. If the number of holdings were to decrease below the probable number indicated earlier in this report, thus implying an even greater increase in average size of holding, the number of hired workers would have to increase if we are to maintain a level of agricultural production of about the same magnitude as now. It is however questionable whether the same high expectation should be placed on employees in the matter of their theoretical basic training as is placed on operators. It may perhaps be more realistic to assume a future education which differentiates between large commercial-scale operators, on the one hand, and small farmers and employees on the other. After basic (preparatory) practical training, the latter could then continue directly with special training courses in machine operation (applied to the growing of crops) or in animal husbandry.

177. Most of the land in farms whose operators will retire during the next fifteen years will be taken over by existing younger operators who wish to increase the scale of their activities. The majority of these will probably be between 25 and 40 years of age. The economic conditions of their operations will in many cases change so radically that these operators will have to improve their own training if they are to tackle the new problems successfully. Many of these men will not have received even a basic vocational training in agriculture. This fact leads to the conclusion that during this period a substantial part of the available educational resouces will have to be directed towards adult education of already active farmers. For that purpose, 10-week courses have in the last year been set up at a number of agricultural schools in close co-operation with the County Agricultural Boards ("lantbruksnämnder") and the County Agricultural Societies ("hushållningssällskap").

178. The educational targets for adults are of importance also in another way. One consequence of a contracting industry, such as Swedish agriculture, is that the proportion of older farmers is high due to the decreased recruitment. These older farmers manage a significant part of the total volume of production but the goal for their particular enterprises is to reduce gradually their labour input. They have a need for training which is different from that of those who manage stable or expanding farm enterprises. The older farmers need guidance on the best way of transferring capital from one generation to another, and on the organisation of farm operations when the planning 'time-horizon' is short and when high priority must be given to convenience. The emphasis is here not on receptivity to change but on planning under uncertainty with a minimum of disruption. Not only will the content of the adult training courses for the older farmers be partly different from what would be appropriate for the younger ones, but the technique of training will probably also differ. The older farmers will naturally have more problems of sight and hearing than will other farmers. Thus, the conclusion is that a contracting industry cannot decrease proportionately its training needs. On the contrary, the remaining farmers first of all need some form of accelerated basic training and, secondly, special training needs arise which are partly consequences of the contraction process itself.

179. In the northern regions in particular, there is movement among people in the middle age-groups from agriculture to other occupations. The National Labour Market Board in co-operation with the National Board of Education has a special programme for adult vocational training in order to facilitate such mobility from shrinking industries to expanding ones. The

agricultural agencies in such cases have to make clear what possibilities there are, and to help small-farmers in making contact with the county labour market authorities.

180. The training requirements of employed farm managers will in many respects be identical with those of other farmers. Employees in the agricultural service trades and the processing industries will probably need rather different kinds of education. Some of them, particularly those serving at the lower levels, will probably be best served by a practical vocational training of the preparatory type. The needs of other employee groups will probably be best served by a more theoretical, general education of the continuation school type. And a smaller group, those whose future activities will include or touch upon extension work, will need an education equivalent at least to that of well-trained farmers.

b) *Estimated numbers on roll in courses at different levels*

181. From what has already been said, we can draw the conclusion that everyone who enters Swedish agriculture should complete a basic training course. This means a number of about 3,000 a year in such courses. Because of the fact that we are here dealing with a non-compulsory type of training and taking into account our experience of what has happened up to now, (namely that not all those in need of training will look for it), it would be realistic to make an alternative calculation based upon the assumption that 75 per cent of those in need of a basic course will actually seek the opportunity of receiving it. This means about 2,200 a year. These figures should be compared with the annual number of 1,700-1,900 students in such courses today.

182. In paragraph 34 the annual numbers of students completing different types of course were shown. Because the duration of nearly all of these courses is one year or less, these figures also show the relationship between the average total number (or 'stock') of pupils attending each type of course. If we put the number of students in basic courses at 100, the number in preparatory training is 31, in specialised training 26, and in farm management courses 11. The number in preparatory courses has been increasing and it would be realistic to reckon on 35 per 100 in basic courses in the future. The number of persons with specialised training and farm management training will have to be increased in the future, and for the subsequent calculations we assume that there will be 50 students in special courses and 25 in farm management courses per 100 students in basic

TABLE 27. ESTIMATED ANNUAL NUMBERS OF STUDENTS ATTENDING DIFFERENT TYPES OF COURSES 1980

COURSES	RATIOS BETWEEN NUMBERS OF STUDENTS[1]	NUMBER OF STUDENTS	
		ALTERNATIVE I[2]	ALTERNATIVE II[3]
Preparatory training	35	1,050	770
Basic training	100	3,000	2,200
Special courses	50	1,500	1,100
Farm management courses	25	750	550

1. Number of students in basic training = 100.
2. Assumes that all 3,000 persons who will need basic training will in fact seek it.
3. Assumes that only 75 per cent of those who need basic training in fact seek it.

courses. This gives us the tentative forecasts in Table 27. From among these numbers, there will be about 130 students going on to attend "lantmästare" courses and about 100 going on to attend university level training, (para. 171).

IV. PRACTICAL IMPLICATIONS OF THE 1980 TARGETS

183. We have now reached the stage where we will have to make some calculations about the total number of teachers needed to train the postulated numbers of students at different levels as estimated in the previous chapter, and the facilities in the form of buildings, teaching equipment and school-farms which would be needed to carry out this educational programme. Before we begin these calculations, however, we have to make some further assumptions.

184. We have in Chapter III 3 also drawn attention to the special need for training of those farmers of lower middle-age who received no agricultural education in their younger years. Changing conditions in agriculture give rise to an acute need for this category of farmer to be equipped with the economic and technical knowledge he at present lacks. This knowledge will have to be imparted in special courses in the form of accelerated training, but we have made no special provision for this type of training in the subsequent calculations for the following reasons. The need for courses of the above-mentioned type is immediate, but the need will continue only for a short time, perhaps 10 years from now. We therefore have to be aware of this need but is not at all sure that we can persuade this particular type of farmer to take courses. They must not therefore have too much influence on the long-term building-up of facilities for agricultural education as a whole.

185. For the same reasons we have not made any special provision for in-service training courses for farmers. There will always be periods of lower activity during the normal school-year which makes it possible to insert suitable shorter courses in the school programme.

186. When discussing the sizes and number of schools, we have also had to consider the following factors which are relevant for a highly industrialised country such as Sweden:

i) Pupils are to an increasing extent recruited from the non-agricultural sector.
ii) Improved roads and other transport facilities do not restrict movement as much as in the past. Therefore the need for many small schools dispersed over the country is less than it was some years ago.
iii) The aim should be to make schools so large that a specialist can be employed for each principal line of production in agriculture, viz. animal husbandry, growing of crops, machine operation, and farm economics.

1. The Need for Teachers and the Required Number of Places for Pupils

187. In order to simplify the final calculation of the running costs, we have tried to express the total need for teachers and the required number of places

for pupils in the schools as ratios per 100 pupils in basic courses. First we had to estimate the relation between different courses in a specific year and we have chosen 1964—this being the latest year for which data are available — and then we projected this relationship into the future as has been done in Table 27. We even had to estimate the number of lesson-periods for each course from the curricula, and the average number of lesson-periods a year for the present staff of headmasters, graduate and non-graduate teachers. This latter was 220 persons in 1964. From these data, we can get the number of man-years of teaching-time per course, and for a given year the total number of 'teacher-years' in all courses. It is essential to emphasise that this will give us a *minimum* number of teachers. To a large extent the courses are winter courses and during the summer-season some teachers spend their time on work in Country Agricultural Societies or in County Agricultural Boards. The actual number of teachers during courses will therefore be somewhat higher.

TABLE 28. CALCULATIONS OF NUMBERS OF PLACES AND NUMBERS OF TEACHERS

COURSES	BASIC DATA		1964 COURSE ATTENDANCE				ALTERNATIVE COURSE ATTENDANCE			
	AVERAGE NUMBER OF PUPILS PER COURSE	NUMBER OF MAN-YEAR OF TEACHING PER COURSE	NO. OF PUPILS		NO. OF COURSES	NO. OF TEACHERS	NO. OF PUPILS		NO. OF COURSES	NO. OF TEACHERS
			TOTAL	PLACES			TOTAL	PLACES		
	1	2	3	4	5	6	7	8	9	10
Preparatory:										
One-year .	14	1.95	15 } 33	15	1.1	2.14	15 } 35	15	1.1	2.14
Half-year .	10	1.02	18	5	1.8	1.84	20	5	2.0	2.04
Basic:										
One-year .	15	1.80	16 } 100	16	1.1	1.98	16 } 100	16	1.1	1.98
Half-year .	27	1.37	84	84	3.1	4.25	84	84	3.1	4.25
Specialised courses...	16	0.90	21	5	1.3	1.17	50	13	3.1	2.80
Manager:										
One-year .	16	2.95	4 } 15	4	0.25	0.79	8 } 25	8	0.5	1.48
Half-year .	22	1.00	11	11	0.5	0.50	17	17	0.8	0.80
Total ..	..	..	169	140	..	12.67	210	158	..	15.49

Notes on calculations:
Col. 1: from data similar to those in Annex I
Col. 2: from special estimates
Col. 3: from data similar to those in Annex I
Col. 4: derived from Col. 3 by taking account of course duration and time of year
Col. 5: = Col. 3/Col. 1
Col. 6: = Col. 5 × Col. 2
Col. 7: based on ratios in Table 27, with sub-totals split in proportion to corresponding figures in Col. 3
Col. 8: see note on Col. 4
Col. 9: = Col. 7/Col. 1
Col. 10: = Col. 9 × Col. 2.

188. In Table 28 we have put together the figures showing the relationships and ratios. First there are data for the school-year 1964, viz. the average number of pupils per course, and the number of man-years of teaching-effort per course. We have then postulated the numbers of pupils in different courses on two alternative assumptions: (*i*) the 1964 pattern and (*ii*) the pattern in Table 27. The other columns show the corresponding numbers of physical place-needs and the numbers of teachers, assuming that the number of pupils in basic courses is

100 and that the number of teachers per course is the same as in 1964. We find from the calculations that because many of the courses are shorter than one year, the need of actual places in the agricultural schools will be smaller than the total number of pupils. These figures on "places" reflect the fact that most of the preparatory half-year courses are given in summer, when there is plenty of room in the schools as the half-year basic courses are winter courses. In the same way, the special courses are so short that many of them can be given one after the other in the same year. Thus there is a need of 140 places in the schools for 169 pupils in all types of courses or for 100 pupils in basic courses.

189. When the same calculations were made assuming the relation between the numbers of pupils in different types of courses to be the one postulated in Table 27, they give us a total number of 210 pupils in all types of courses for 100 in basic courses and a need of 158 places.

190. The average number of pupils in the different courses is in some cases rather low. It could be said that in the future, when we calculate with a larger total number of pupils, the average number in these courses should be higher. That might be so. But we have chosen to assume that the average class-sizes will be the same as in 1964. It would be easy to make a new alternative calculation assuming the average number in preparatory courses and in special courses to be somewhat higher.

2. NORMAL INVESTMENT AND RUNNING COSTS FOR AGRICULTURAL SCHOOLS

191. Investment requirements and costs of maintenance and operation were estimated for two sizes of schools: 60 pupils a school and 100 pupils a school. The estimation of investment in buildings etc. was based on the programme for the allocation of the floor space required for various purposes in agricultural schools, by comparison with three recently-built schools. Cost of maintenance and operation (see Table 29) were collected from actual balance-sheets of some agricultural schools. For the estimation of costs of the school-farms, a comparison was made by the Swedish Forest Service (Domänverket) of the purchase-value of built-up farm land, recently built schools in central Sweden and the statistics collected by the Federation of Swedish Farmers' Association (Sveriges Lantbruksförbund) covering large farms in southern Sweden. In the calculation,

TABLE 29. STANDARDS FOR ESTIMATING THE COST OF AGRICULTURAL VOCATIONAL TRAINING FOR 60-PUPIL AND 100-PUPIL SCHOOLS AND AT 1964 PRICES

ITEM	60-PUPIL SCHOOL		100-PUPIL SCHOOL	
	INVESTMENT *Kronor million*	ANNUAL EXPENDITURE *Kronor*[1]	INVESTMENT *Kronor million*	ANNUAL EXPENDITURE *Kronor*[1]
1. Premises and rooms	2.8	200,000	3.6	266,000
2. Furniture and fixtures	0.4	15,000	0.6	24,000
3. Educational material (excl. machines)	0.1	3,000	0.2	4,000
4. School farms (excl. woodland) .	2.0	—	2.0	—
Total	5.3	218,000	6.4	294,000

[1] The cost of teachers is not included.

the school-farms are assumed not to give rise to any annual expenditure on the part of the Government. Although it is very unlikely that such costs can be avoided in the future, we have not included any running costs for school-farms in the following calculations.

The annual expenditure for premises and rooms included in the above table comprise the following items:

Kronor.

ITEM	60-PUPIL SCHOOL	100-PUPIL SCHOOL
Interest	50,000	65,000
Depreciation	70,000	90,000
Fuel and other energy	35,000	45,000
Maintenance	25,000	40,000
Office and telephones	20,000	26,000
Total	200,000	266,000

192. Pupils pay for board and lodging but through students assistance schemes, they get grants from the State to cover a part of these costs, and the schools also subsidise them to some extent through low prices. We have simplified the calculations by excluding the cost of pupils' board and lodging.

193. On the basis of the financial statements of a number of existing schools, and including all teacher-costs (viz. salaries, pension contributions, medical treatment, etc), the mean cost per lesson period is Kronor 44 and the mean annual cost is Kronor 40,000 per teacher. From the data given in Table 28 we can estimate the yearly cost for teachers for schools of 60 pupils and 100 pupils respectively:

i) The relation between courses is the same as in 1964.

$$\text{The 60-pupil school: } \frac{12.7 \times 40{,}000 \times 60}{140} = \text{kronor } 218{,}000$$

$$\text{The 100-pupil school: } \frac{12.7 \times 40{,}000 \times 100}{140} = \text{kronor } 362{,}000$$

ii) The relation between courses will be the one assumed in Table 27.

$$\text{The 60-pupil school: } \frac{15.5 \times 40{,}000 \times 60}{158} = \text{kronor } 235{,}000$$

$$\text{The 100-pupil school: } \frac{15.5 \times 40{,}000 \times 100}{158} = \text{kronor } 392{,}000$$

3. Final Calculations

194. We have now given all the data necessary to make the final calculations for different alternatives. The number of schools today is 50. In the following calculations, we have assumed that the number will be 40 (except in the last estimate where we have used the figure of 48 schools in order to avoid unreasonably large schools), since the tendency today is a decrease in the total number of schools. We have experience of agricultural schools of a size of 125 pupils following different courses at the same time and we could envisage schools of sizes up to 150 pupils; but perhaps they should not be much larger than that because of the difficulties in arranging for practical training.

TABLE 30. PROJECTION OF NUMBERS OF TEACHERS AND SCHOOLS AND OF CAPITAL AND CURRENT EXPENDITURE

BASIS OF ESTIMATE	PLACES	PUPILS	TEACHERS	SCHOOLS			CAPITAL VALUE		ANNUAL CAPITAL EXPENDITURE		ANNUAL CURRENT EXPENDITURE		
				60-PUPIL	100-PUPIL	TOTAL	TOTAL	INCREASED CAPACITY	DEPRECIATION	INCREASED CAPACITY	TEACHING COSTS	OTHERS	TOTAL
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Number						*Mill. Kronor*						
Budget 1965/66	2400	2900	215	..	..	50	225	—	4.6[1]	—	8.7	3.8	12.5[2]
Projections to 1980													
A	2400	2900	220	40	—	40	212	—	7.1	—	8.7	8.7	17.4
B	3150	3800	280	20	20	40	234	22	7.8	1.5	11.6	10.2	21.8
C	3550	4700	350	10	30	40	245	33	8.2	2.2	14.1	11.0	25.1
D	4700	6300	460	—	48	48	308	96	10.3	6.4	18.8	14.1	32.9

.. Not available
— Nil.
1. Actual provision for expenditure.
2. Excluding interest and depreciation.

NOTES ON CALCULATION :
Col 1: Government budget proposals for 1965/66. For alternative assumptions A to D see paragraph 195.
Col 2: From text, paragraph 195.
Col 3: Col 2 × Pupil/Place ratio derived from Table 28. For 1965/66, A and B: 169/140 = 1.21, for C and D: 210/158 = 1.33.
Col 4: Col 2 × Teacher/Place ratio, or Col 3 × Teacher/Pupil ratio, derived from Table 28.
Col 5 to 7: From text, paragraph 195.
Col 8: Col 5 × 5.3 *plus* Col 6 × 6.4, from Table 29.
Col 9: From Col 8.
Col 10: Col 8 × 1/30 i.e. "Straight-line" depreciation over 30 years. Annual expenditure for the projections assumed to equal this amount.
Col 11: Col 9 × 1/15 i.e. increased capacity assumed to be built, at unchanged prices, between 1965 and 1980.
Col 12: Sum of Cols 5 and 6 respectively multiplied by the appropriate figure from paragraph 193.
Col 13: Sum of Cols 5 and 6 respectively multiplied by the appropriate annual expenditure figure from Table 29.

195. In Table 30 we have put together data for number of pupils, number of teachers, investment costs and running cost including cost for teachers, for the situation today calculated from the budget for 1965/66 and for four different alternatives of school attendance in the future. The four alternative assumptions and their educational consequences in terms of pupil numbers and school numbers are set out below.

Alternative (*A*): Unchanged attendance at the agricultural schools, which means about 1,750 pupils in basic courses (Table 6) and a total capacity of 140 places per 100 pupils in basic courses (Table 28). The total number of places would then be about 1.40 × 1,750 or about 2,400, and the total number of pupils would be about 1.69 × 1,750 or about 2,950. For simplicity we show in Table 30 the 1965/66 total budgeted numbers (viz. 2,900), but we assume that there will be only 40 schools.

Alternative (*B*): 75 per cent of the estimated annual recruitment in agriculture in 1980 will attend basic vocational courses, but assuming continuation of the 1964 relative distribution of pupils between courses (i.e. 140 places needed per 100 "basic" pupils). The projected figure for annual recruitment is about 3,000; 75 per cent or 2,250 will get basic vocational training. For 2,250 pupils in basic courses, room is required for 1.40 × 2,250 or 3,150 pupils at the same time. This would involve an increase of about 33 per cent in the total amount of accommodation, and could be achieved if, for example, 20 of the 40 schools increased their capacity from 60 to 100 pupils.

Alternative (*C*): Same as Alternative (B) but the pattern of training shifts towards the upper levels, as postulated in Table 27. The number of man-years of teaching effort, and the number of places, per 100 pupils in basic courses will thus rise from 12.7 to 15.5 and from 140 to 158, respectively (Table 28). The number of pupils in basic courses will be the same as in Alternative (B), or 2,250, but room is required for about 3,550 (1.58 × 2,250). This could be provided by, for example, 30 schools with a capacity of 100 pupils and 10 with room for 60 pupils.

Alternative (*D*): 100 per cent of the estimated annual recruitment in agriculture in 1980 will attend agricultural vocational training and the pattern of course attendance will be as in Table 27. 3,000 pupils in basic courses will require room for about 3,000 × 1.58 or about 4,750 pupils at the same time. It seems realistic to assume that in the foreseeable future the average size of the agricultural schools will not be larger than 100 pupils a school and if this size is not to be exceeded, then 48 schools would be required.

V. COMMENTARY ON THE 1980 FORECAST

1. STATISTICAL PROBLEMS

196. To make a forecast of the kind presented here, which is based upon an attempt to form an opinion of the probable future development with the help of the development of events in earlier stages, and with due regard to

various kinds of influence, is for obvious reasons complicated. Because of the complexity of our modern society the factors which can affect the development of events can only be analysed roughly. It is therefore important that basic material which gives information on the development in earlier stages should describe the actual events accurately. Official agricultural statistics are very much focused on the land from the point of view of a land-use survey, on the one hand, and on livestock and equipment, on the other. There are big gaps in the data on the people working on the land. We are unable to find e.g. any figures of the present number of farmers who have received vocational agricultural training[1]. Comparisons are also rendered more difficult by the fact that when some attempt has been made in the past to collect data, the forms of question and the classification systems used have been changed from one census to another. It has already been mentioned that in Sweden although some fairly comprehensive statistics are available for studies of the kind presented here, certain deficiencies in this material exist, as was pointed out in Chapter III. These are considered further in the "Conclusion and Recommendations".

2. THE VALIDITY OF THE PLAN

197. When a plan has been formulated, a test of some sort is needed to show if it is a valid plan or not, i.e. if it summarises what it intends to summarise and if it is workable. The validity has to be discussed with respect to the time dimension: i.e. the immediate present and the future validity. As regards the first aspect, it would be very desirable to have the comments of people directly involved in general and agricultural school-planning. This 'sounding' might reveal the validity of the following main points:

i) Are the basic assumptions in the plan agreed upon? The Swedish plan, for example, assumes improved recruitment possibilities in agriculture.

ii) Are the results obtained for manpower requirements and training needs by occupation plausible, i.e. do they agree with other comparable trends and with the goals in general educational policy?

198. In order to avoid mistakes in these directions, and to make the plan psychologically more 'acceptable' to the agricultural sector, it is essential that the planning should be carried out in close cooperation with the representatives of the agricultural sector and of its associated activities. The plan ought ideally to develop as a result of a continuous 'dialogue' between the planning authorities and the other interests concerned: this needs to be emphasised, because hitherto the planning of agricultural education in Sweden has been almost entirely the responsibility of the central and/or local government authorities.

199. Another type of immediate validity concerns the workability of the plan for different regions in agreement with local boards and—after discussion and revision— to aggregate the regional figures in such a way that the total figures obtained do not exceed the originally calculated national ones.

200. A third type of immediate validity has to do with the logical structure of the plan. One question in this context is the agreement of the results obtained with the basic assumptions. Another question which can be put is the degree of rigidity of the plan, i.e. which parts of the plan have been regarded as more

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[1] Such an investigation is planned to start in the autumn of 1966. It is to be carried out by the Agricultural Economics Research Institute, Stockholm.

fixed than others. In the Swedish plan the syllabus of the courses, the availability of textbooks and the recruitment of teachers are fixed parts of the plan. A change in the syllabus might, however, change the resource needs of schools as well as the need for textbooks and, particularly, for the training of teachers. Thus the different parts of the plan are interrelated and cannot in reality be regarded as rigid. A possibility of studying the validity of having fixed parts of the plan would be to estimate the quantitative effect on different parts of the plan of a defined change in those parts of the plan which are assumed to be fixed. There are two particularly flexible parts of the Swedish plan: the manpower requirements and the educational targets. Even here, however, the discussion is based upon the goals in the present agricultural policy and the present setup. A complete institutional change in Swedish agriculture, e.g. into very large business units, is not and cannot be anticipated in the plan.

201. The discussion on the flexibility of the plan leads to the other validity aspect, the future validity. The plan can never be regarded as given once for all. On the contrary, it has to be continuously revised and checked. This is due to at least two circumstances. First, the basic assumptions in the plan can be changed or turn out to be incorrect and thus give rise to a revision. And second, effects of the plan which were not anticipated and which were not intended can be taken into consideration.

202. The validity problems as well as the practical problems in connection with educational planning can be summarised in the following check-list.

a) *The implementation of the plan*

- *i*) Which institutions have been consulted in the formulation of the plan and in which way?
- *ii*) How is the agricultural plan co-ordinated with more general plans relating to:
  - — general education?
  - — the extension service?
  - — further education?
  - — training for occupational change?
  - — forestry education?
  - — home economics education?
- *iii*) How is the plan adjusted regionally?
- *iv*) How is the plan followed up and revised?
- *v*) Can the plan be carried out within the framework of existing resources?
- *vi*) How can the agricultural schools activate agriculture in their neighbourhood?

b) *The consequences of the Plan*

- *i*) Does the very publication of the plan influence:
  - — out-migration from agriculture?
  - — the career prospects in agriculture?
  - — the 'stock' of young people from whom agriculture draws its recruits?
  - — the enrolment-ratio in agricultural schools, and the dropout-coefficients during or after completion of the various courses in the schools?

ii) How does the plan influence:
   - the syllabus of the courses?
   - the supply of suitable textbooks?
   - the recruitment of teachers?
   - the centralisation of agricultural schools?
   - the investment needs of the schools?
   - the operating costs of the schools?

iii) How do the authorities solve unforeseen changes from the estimated annual recruitment figures:
   - when there are great variations from one year to another?
   - when there is a continuous increase or decrease?

iv) What economic and social problems can arise for those who cannot or have not the opportunity to train themselves in agriculture:
   - if they stay in agriculture?
   - if they leave agriculture?

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[1] SOS means: Official Statistics of Sweden.

[2] SOU means: Official Investigations of the Government.

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STATISTICS ON EDUCATION PROVIDED BY THE AGRICULTUR

TYPE OF COURSE	COURSE
1. Preparatory vocational training	
Practical-theoretical course, 39-42 (-52) weeks	8
Summer or winter course, about 21 weeks	32
Total	40
2. Basic training	
Practical-theoretical course, 42 weeks (including older courses called one-year courses, whole-year courses, and winter and continuation courses)	26
Courses of minimum 21 weeks (winter courses or equivalent)	
of agricultural bias	49
forestry side	11
horticultural side	2
Total	88
3. Specialized training in the form of special training courses, 8-12 weeks	39
4. Training of foremen, managers and head cowmen	
Foreman and manager courses, 42 weeks (only in 1963/64)	–
Shorter manager course, 21 weeks (only in 1963/64; for the other two school-years the figures are for the so-called longer courses)	7
Two-year agricultural school courses	3
One-year head cowman courses	13
Total	23
5. Lantmästare	1
6. In-service training	
Courses arranged by the agricultural schools	142
Courses arranged at the agricultural schools but, wholly or partly, by the County Agricultural Societies ("hushållningssällskapen") or by the County Agricultural Boards ("lantbruksnämnderna")	149
Courses arranged outside the agricultural school but with the participation of the teachers of the school	51
Total	342

ex I

HOOLS IN THE SCHOOL-YEARS 1961/62, 1962/63, AND 1963/64.

1961/62		1962/63			1963/64		
PUPILS	PUPIL-DAYS	COURSES	PUPILS	PUPIL-DAYS	COURSES	PUPILS	PUPIL-DAYS
114	31,562	12	173	44,258	19	271	71,541
380	45,147	34	357	42,651	34	357	44,533
494	76,709	46	530	86,909	53	628	116,074
361	82,294	24	304	83,956	19	263	76,193
1,201	166,087	47	1,188	163,238	47	1,238	173,312
187	31,662	14	247	34,166	12	237	33,264
24	3,150	2	24	3,175	2	32	4,200
1,773	283,192	87	1,763	284,535	80	1,770	286,969
466	27,080	35	391	27,199	37	487	32,088
—	—	—	—	—	2	32	8,736
121	15,935	8	148	18,464	10	188	23,697
24	8,015	2	16	5,840	—	—	—
44	14,912	13	51	18,151	4	18	6,400
189	38,862	23	215	42,435	16	238	38,833
60	15,120	1	60	15,120	2	96	24,192
4,034	17,826	124	3,963	16,304	96	2,050	14,621
5,095	14,521	125	3,883	13,921	94	2,271	19,499
1,253	3,750	29	1,152	3,208	58	155	851
10,382	36,097	278	8,998	33,433	248	4,376	34,971

Annex II

AGE DISTRIBUTION OF FARM OPERATORS BY FARM SIZE IN SWEDEN ADJUSTED CENSUS DATA FOR 1950 AND 1960, AND PROJECTIONS TO 1980 OF TOTAL NUMBERS AND OF ANNUAL RECRUITMENT[1]

SIZE-GROUP YEAR	TOTAL NUMBERS IN AGE-GROUPS							RECRUITMENT (+)				RETIREMENT (−)
	-24	25-34	35-44	45-54	55-64	65-	TOTAL	-34	35-44	45-54	TOTAL, UP TO 54 YEARS OF AGE	
50.1 ha 1950	147	1,398	2,079	1,991	1,758	1,158	8,531					
and over 1960	40	824	2,013	2,168	1,438	542	7,025	717	615	89	1,421	− 2,927
1970	12	471	1,188	2,113	1,567	367	5,718	443	364	100	907	− 2,214
1980	4	268	681	1,249	1,531	358	4,091	260	210	61	531	− 2,158
1960-1980	—	—	—	—	—	—	—	703	574	161	1,438	− 4,372
annually	—	—	—	—	—	—	—	35	29	8	72	
20.1-50 ha 1950	483	4,847	8,078	8,622	6,576	4,326	32,932					
1960	218	3,713	8,348	9,313	6,658	2,100	30,350	3,448	3,501	1,235	8,184	− 10,766
1970	100	2,807	6,413	9,618	7,194	1,691	27,823	2,689	2,700	1,270	6,659	− 9,186
1980	47	2,109	4,863	7,403	7,427	1,718	23,567	2,056	2,056	990	5,102	− 9,358
1960-1980	—	—	—	—	—	—	—	4,745	4,756	2,260	11,761	− 18,544
annually	—	—	—	—	—	—	—	237	238	113	588	
10.1-20 ha 1950	784	8,012	15,296	17,266	13,232	8,671	63,261					
1960	320	5,036	12,819	16,896	14,200	5,582	54,853	4,572	4,807	1,600	10,979	− 19,387
1970	131	3,138	8,077	14,203	13,892	5,044	44,485	2,949	3,041	1,384	7,374	− 17,742
1980	54	1,946	5,045	8,965	11,673	4,822	32,505	1,869	1,907	888	4,664	− 16,644
1960-1980	—	—	—	—	—	—	—	4,818	4,948	2,272	12,038	− 34,386
annually	—	—	—	—	—	—	—	241	247	114	602	

2.1-10 ha 1950	1,897	17,089	37,294	47,641	43,969	31,740	179,630	3,595	—	—	3,595	— 82,371
1960	346	5,146	15,868	27,226	32,343	19,925	100,854	1,343	—	—	1,343	— 50,940
1970	68	1,621	4,973	11,967	18,746	13,882	51,257	474	—	—	474	— 28,608
1980	15	527	1,616	3,853	8,354	8,758	23,123	1,817	—	—	1,817	— 79,548
1960-1980	—	—	—	—	—	—	—	91	—	—	91	
annually	—	—	—	—	—	—	—					
Total[2] 1950	3,311	31,346	62,747	75,520	65,535	45,895	284,354	12,332	8,923	2,924	24,179	—115,451
1960	924	14,719	39,048	55,603	54,639	28,149	193,082	7,424	6,105	2,754	16,283	— 80,082
1970	311	8,037	20,651	37,901	41,399	20,984	129,283	4,659	4,173	1,939	10,771	— 56,768
1980	120	4,850	12,205	21,470	28,985	15,656	83,286	12,083	10,278	4,693	27,054	—136,850
1960-1980	—	—	—	—	—	—	—	604	514	235	1,353	
annually	—	—	—	—	—	—	—					

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1. See examples of the derivation method on the next page.
2. It should be noted that within a given age-group, recruitments to one size-group may be offset by retirements from another size-group, and that in consequence recruitments derived from the total figures for all size groups together may be less than the sum of recruitments derived from each size group separately.

Source: Working tables of the 1950 and 1960 Population Censuses/Råtabeller till 1950 och 1960 års folkräkning.

EXAMPLES SHOWING THE DERIVATION OF RECRUITMENT AND RETIREMENT FROM TOTAL NUMBERS IN AGE-GROUPS

Size group 'Over 50 ha'

Recruitment			
	25-34 in 1960	824	
Less	Under 25 in 1950	− 147	
		677	
Plus	Under 25 in 1960	+ 40	
	Recruitment under 34 in period 1950-1960...	717	
Retirement			
	45-54 in 1950	1,991	
Less	55-64 in 1960	− 1,438	
		553	553
	55-64 in 1950	1,758	
Less	Over 64 in 1960	− 542	
		1,216	1,216
	Over 64 in 1950	1,158	1,158
	Retirement in period 1950-1960		2,927

Annex III

NUMBER OF OPERATORS, ASSUMING RECRUITMENT TO FARMS OVER 10 HECTARES DURING THE 1960s AND 1970s AT THE SAME ABSOLUTE RATES AS DURING THE 1950s

1. Recruitment of operators to holdings over 10 hectares

1950-1960 2,058 per annum (24,179-3,595)/10. From Annex II
1960-1980 Orginal 1,262 per annum (27,054-1,817)/20. From Annex II.
Alternative 2,058 per annum. Derived from following figures, as in example in Annex II[1]

OPERATORS OF HOLDINGS OVER 10 HECTARES	-25	25-34	35-44	45-54	55-64	65-69	70-	TOTAL
1950	1,414	14,257	25,453	27,879	21,566	6,593	7,562	104,724
1960	578	9,573	23,180	28,377	22,296	5,107	3,117	92,228
1970	578	8,737	18,496	26,104	22,653	7,102	—	83,670
1980	578	8,737	17,660	21,420	20,631	6,898	—	75,924

2. Recruitment of operators to holdings of 2-10 hectares

1950-1960 360 per annum (3,595/10) } From Annex II
1960-1980 91 per annum (1,817/20) }

OPERATORS OF HOLDINGS OF 2-10 HECTARES	-25	25-34	35-44	45-54	55-64	65-69	70-	TOTAL
1950	1,897	17,089	37,294	47,641	43,969	15,016	16,724	179,630
1960	346	5,146	15,868	27,226	32,343	11,407	8,518	100,854
1970	68	1,621	4,973	11,967	18,746	13,882	—	51,257
1980	15	527	1,616	3,853	8,354	8,758	—	23,123

3. Recruitment of operators to all holdings over 2 hectares

1950-1960 2,418 per annum (24,179/10) From Annex II
1960-1980 Original 1,353 per annum (27,054/20). From Annex II
Alternative 2,149 per annum. From 1 and 2 above

ALL OPERATORS ON HOLDINGS OVER 2 HECTARES[2]	-25	25-34	35-44	45-54	55-64	65-69	70-	TOTAL
1950	3,311	31,346	62,747	75,520	65,535	21,609	24,286	284,354
1960	924	14,719	39,048	55,603	54,639	16,514	11,635	193,082
1970	646	10,358	23,469	38,071	41,399	20,984	—	134,927
1980	593	9,264	19,276	25,273	28,985	15,656	—	99,047

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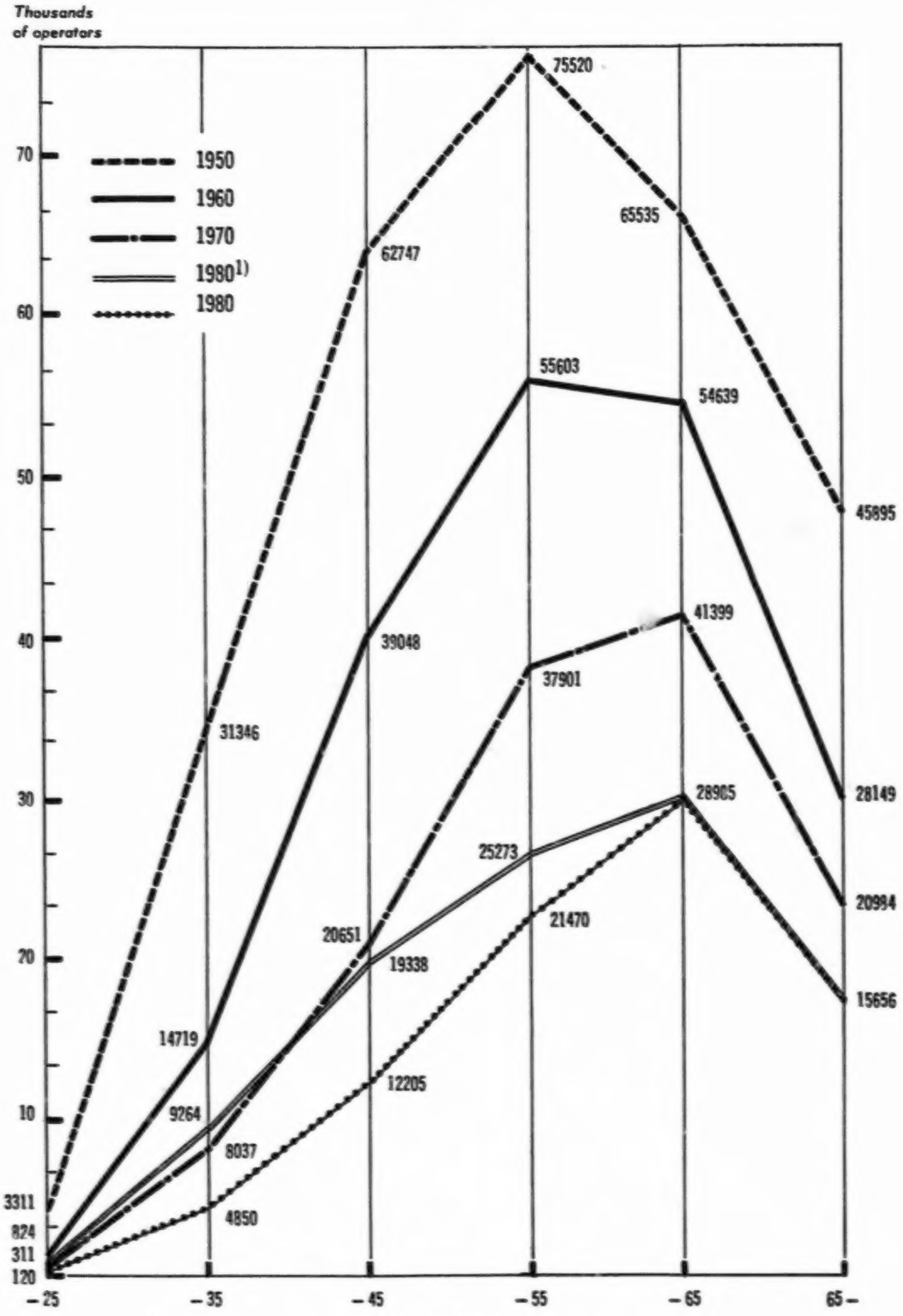
[1] The annual average rate of recruitment derived from the data in 1 is necessarily the same in 1960-1980 as in 1950-1960 simply because this is the postulate underlying the construction of the above alternative projection for holdings over 10 ha.

[2] See footnote 1 to Annex II.

Annex IV

NUMBER OF OPERATORS IN VARIOUS AGE-GROUPS
1950-1980



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1. Assuming that farms over 10 hectares will have the same recruitment during the 60s and 70s as during the 50s.

Annex V

ADJUSTMENT OF BASIC POPULATION CENSUS DATA ON FARM OPERATORS FOR "METHOD 2" PROJECTIONS

The analysis of changes between 1950 and 1960 in the distribution of operators by size-group of holding could not be made directly from a comparison of the results of the population censuses for those two years, because only the 1950 census asked respondents who gave their occupation as "farm operator" to state the size of their holding. The 1960 figures were obtained by matching the census schedules of operators with the corresponding entries in the central farm register kept by the Swedish National Farmers' Union (RLF: Centrala jordbruksregister). There were other difficulties too: only 318,430[1] out of the 323,876 operators recorded in the 1950 census in fact gave adequate information about the size of their holding[2]. This latter figure is comparable with the total of 206,804[3] persons who gave their occupation as "operator" in the 1960 census. Of this last number, however, only 181,166 could be matched-up with entries in the central farm register so that no size-group data were available for 206,804-181,166 or 25,638 operators in 1960, or for 323,876-318,430 or 5,446 operators in 1950.

The following three adjustments were made in order to arrive at broadly comparable figures for 1950 and 1960:

i) Elimination of a notional 'unclassifiable' group of operators from the 1960 total, to make the adjusted figure comparable with the 318,430 operators who in 1950 could be classified by size of holding. This adjustment was made by assuming that in 1960 the same proportion of the overall total as in 1950 (viz 5.4/323.9 or 1.7%) consisted of unclassifiable replies.

ii) Elimination from the 'classifiable' totals for 1950 and 1960 of operators on holdings of 2 hectares or less. (This adjustment was made on account of the fact that many, if not most, holdings of 2 ha and below are not truly agricultural production units). This gave an estimate of the number of 'notionally classifiable' operators on holdings of over 2 hectares.

For 1950, the figure was (by definition) available. For 1960, a reduction by 70% of the 1950 figure was used. This percentage was chosen in the light of the pattern of reductions observed for the three size-groups immediately above 2 hectares. This comparison was made initially by using only those 1960 operators for whom size-of-holding could be derived from the Farmers' Union register, and a second comparison was made when these incomplete figures were adjusted upwards (see (*iii*) below) to correct—albeit roughly—for the incomplete coverage of the Farmers' Union central register. The two patterns of reduction were as follows:

SIZE-GROUP OF HOLDING (HA)	PERCENTAGE FALL IN NUMBER OF OPERATORS, 1950-60	
	UNADJUSTED BASIS	ADJUSTED BASIS
10.1-15.0	21	15
5.1-10.0	45	36
2.1- 5.0	58	54

It seemed reasonable to assume that the percentage fall in the number of operators on holdings of 2 ha. and below was considerably greater than 55-60 percent.

iii) The third adjustment was to increase the numbers of operators in each age-group/size-group of holding in proportion to the ratio:

$$\frac{\text{Estimated number of 'notionally classifiable' operators on holdings of over 2 ha}}{\text{Actual number of classifiable operators on holdings of over 2 ha}}$$

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1. Folkräkningen 1950 (The Population Census) Stockholm 1955, Working Table 11 and Vol. VI, Table 1.
2. An appraisal of this discrepancy is given by T. Wallin in Statistisk Tidskrift 1962, no. 9.
3. Folkräkningen 1960, Working Table 39 and Vol. IX, Table 3.

This adjustment was made separately for each of the following hectare size groups: 2.1-5.0; 5.1-10.0; 10.1-15.0; 15.1-20.0; 20.1-30.0; 30.1-50.0 and 50.1-100.0. The actual number of matched holdings over 2 ha for which size data were available for 1960 was 175,631.

The application of the first two of these adjustments is shown below:

	1950	1960
All gainfully employed operators	323,876	206,804
Less unclassifiable operators	−5,446	−3,500
	318,430	203,304
Less operators of 2 ha or less	−34,076	−10,223
	284,354	193,081

The third adjustment coefficient is then 193.1/175.6 or 1.099.

An alternative possible basis for estimating the number of holdings of 2 hectares or less would have been to have taken the actual number of 'matched' holdings of 2 ha or less in the central farm register and then to have adjusted this number upwards by the ratio:

$$\frac{\text{Estimated total number of 'notionally classifiable' operators}}{\text{Actual total number of classifiable operators}}$$

This ratio would be $\frac{203.3}{181.2}$ or 1.12 and the number of 'matched' holdings of 2 ha or less was 181,166 *less* 175,631 or 5,535 so that, by this method, the estimated total number of holdings in this size-group in 1960 would be 1.12 × 5,535 or about 6,200. This would imply a decrease by 34,076 *less* 6,200 or 27,876 i.e. nearly 82% (compared with the decrease of 70% assumed in the adjustment actually used). The effect on adjustment (*iii*) would be very much less, as the following figures show:

	1950	1960
All gainfully employed operators	323,876	206,804
Less unclassifiable operators	−5,446	−3,500
	318,430	203,304
Less operators of 2 ha or less	−34,076	−6,200
	284,354	197,104

The coefficient for adjustment (*iii*) is then $\frac{197.1}{175.6}$ or 1.122 compared with 1.099. In view of the necessary roughness of all the adjustments on either basis, and the other shortcomings of the basic data and the analysis of changes in age-groups and size-groups, it would seem unreasonable to treat 1.099 or 1.122 as significantly different from 1.10.

The results of the cross-classification of operators by age-group and by size-group of holding are summarised in Annex II.

It is of interest to note that the difference in 1960 between the total number of operators (206,804) and the number of 'matched' operators (181,166), namely 25,638, is made up as follows:

Notional 'unclassifiable' replies:	3,500
Estimated 'unmatched' operators on holdings of 2 ha and less (10,223-5,535)	4,688
Under-coverage of operators on holdings of over 2 ha (193,081-175,631)	17,450
	25,638

COMPARATIVE ANALYSIS OF THE PROJECTION METHODS USED IN THE PILOT STUDIES

by

W.N.T. Roberts

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COMPARATIVE ANALYSIS OF THE PROJECTION METHODS USED IN THE PILOT STUDIES

by

W.N.T. ROBERTS

1. INTRODUCTION

1. The purpose of this part of the Report is to review and assess the preceding two pilot studies in the context of the general problem of manpower forecasting and educational programming, but taking account of certain features which affect only the agricultural sector or which affect it much more than other sectors of the economy. Attention will be focussed on those parts of the pilot studies which are of greatest methodological interest, which is another way of saying that this discussion will not give equal weight to each and all of the several stages of the projection exercise. From time to time, some tentative conclusions are proposed. Some proposals for further work both in the field of methodology and in the fundamental field of basic data collection and presentation are made in the chapter "Conclusions and Recommendations". Without adequate basic data, further methodological research will be of only limited value.

2. Before dealing further with some of the particular features of the agricultural forecasting problem, it will be appropriate to summarise the broad principles underlying manpower forecasting and educational planning in general.

II. PROJECTION OF TRAINING REQUIREMENTS

1. USUAL METHODS[1]

3. It is usual to distinguish between short-term (one year or so), medium-term (5 years or so) and long-term (10-20 years) planning, since the data and the methods adequate for the one may be unavailable, unnecessary or unacceptable for the others. It is often desirable, though less often possible, to make projections independently for the supply of and the demand for personnel in particular sectors or occupations and/or at given levels of educational attainment. Another conceptual distinction is that between desirable, possible and probable sizes and compositions of the labour force, either as a whole or in particular sectors of the economy.

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[1] See bibliography on page 188 for some of the main sources where fuller discussions can be found.

a) *The total labour force*

4. Apart from accepting official government projections (where they exist and which, moreover, probably use one or more of the following approaches), the following are the main methods of manpower forecasting available to the educational planner:

Labour Supply:

i) Direct extrapolation of trends in past decade or so of total labour force and its main sectoral components. Such extrapolations need not necessarily be linear (e.g. if the basic data suggest a change in annual absolute increments or decrements).

ii) Direct extrapolation of trends in the output of the educational system at different levels, taking account of 'labour force participation rates' (i.e. the proportion of the total number in an age/sex group who are actually or likely to be in the labour force).

iii) Demographic projection of the labour force in terms of observed and expected rates of recruitment and of wastage through death and retirement in different age/sex groups.

Labour Demand:

iv) Project trend in labour productivity or analogous ratios (e.g. labour/output, labour/value-added, labour/turnover) and apply projected figures to projected values of corresponding national, sectoral or industrial aggregates (e.g. GNP, sectoral output, industry value added or industry turnover).

v) Study past trend and likely future opportunities in the employment of specific types of manpower.

5. Although for simplification, the above methods have been divided into "Supply" and "Demand" approaches, it is clear that none of them is truly independent of the complementary 'pull' or 'push' of the market; thus, for example, the past trend in the size and composition of the labour force (Method (*i*)) is itself partly determined by the past sectoral pattern of demand for labour, and the trend in labour productivity, or other analogous ratios (Method (*iv*)) is itself partly determined by the availability and cost of labour.

b) *Educational implications*

6. When the likely future size and sectoral or industrial composition of the labour force has been arrived at, the next stage is to transform this into a corresponding projection of the composition of the total manpower stock in terms of educational attainment. This may be done either by an analysis of the past and future manpower stocks in terms of occupation, and of the training judged necessary for each occupation, or by trying to establish a direct relationship between the size and composition of a sector's or an industry's output and the size and broad educational composition of the corresponding labour force.

7. Either before or after the estimation of the educational composition of the future total manpower stock, this *stock* must be transformed into the corresponding annual *flow* of recruits necessary to attain and maintain it. If this transformation is made before the educational-needs analysis, then this analysis will relate to the annual flow of recruits rather than to the total manpower

stock. In either case, of course, the level of the projected stock will be different for each year between the point in time at which the projection is made, and the final year of the projection period, and consequently the annual flow of recruits to the labour force will itself change in total volume (and possibly also in educational composition) in each year of the exercise.

8. The preceding list of broad methods does not pretend to be exhaustive, nor is the above brief summary of steps in making projections intended to suggest that the problem is simply a matter of geometry or of calculation once the key rates of change have been identified or decided upon. There are numerous conceptual and definitional problems, such as how to take account of efficient operators or employees in a job for which they have had little or no formal training, or of persons who have been trained for one occupation or industry but who work in another.

9. The last stages of the exercise consist in assessing the type and duration of training necessary (or desirable) for specified occupational groups, and the subsequent transformation of projected annual flows towards these occupational groups into corresponding 'graduate'[1] flows out of, and student stocks and flows within the various parts of the formal training system. Here again, numerous problems arise, such as the distinction between 'necessary' and 'desirable' training, the substitutability of formal full-time training by in-service training, and of full-time by part-time training.

2. Agricultural Complications

10. The basic approach to manpower forecasting and educational programming in agriculture must, of course, follow the same general principles as those summarised in the preceding paragraphs, but as has already been mentioned there are certain peculiarities of the agricultural sector that add to the difficulties of the exercise.

11. In the case of rural manpower, it is in principle necessary to consider the volume and attributes of at least four concepts of labour outflow:

i) the movement out of agriculture (and maybe out of rural areas) of people who prefer to seek their livelihood in non-agricultural work;
ii) the movement out of agriculture that is desirable if governments' declared income policies for agriculture are to be attained;
iii) the shrinkage of the agricultural labour force that is implied by projected levels of farm output and labour productivity; and
iv) the movement from agriculture into other sectors that can be readily absorbed by economic development in urban and rural areas.

All four concepts are of course inter-related and are influenced by, amongst other things, existing levels of education and skill, and facilities for training or re-training. In the present report, the French study considers primarily(*i*)—which is explicitly treated as being very largely dependent upon (*iv*), whilst the Swedish study considers (i) and (iii), and implicitly regards (*iii*) as greatly influenced by (*ii*).

12. The more significant of the special peculiarities of agriculture are set out below.

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[1] 'Graduate' is here used to mean a person who has completed a given level and type of training.

a) *Poor job demarcation.* For a number of reasons—e.g. the 'family-scale' nature of operations over a large part of the sector, the consequent low or zero marginal cost of labour during much of the year, the great seasonal variation in the total amount and the daily composition of the work-load—the theoretically full-time farm operator is in practice likely to be doing a great deal of routine manual work, and his nominally specialised workers (if indeed he has any) may at some times of the year be engaged not in farm operations but in building construction, drain-laying or road-making. In some countries—and Sweden is a good example—the operator may himself spend part of this time in forestry or even in sea-fishing.

b) *Ill-defined total labour force.* Even if the farm operator works full-time in agriculture, very probably his wife and school-age children devote part of their time to farm work either regularly or during peak periods such as harvest time. Further, the operator may be assisted by seasonal labourers who work full-time whilst they are on the farm, or by irregular labourers who may divide their time between two or more farms, or between occasional but useful farm work and voluntary unemployment. In these circumstances, it is clearly very difficult to quantify the total volume of labour input to farm operations, unless either frequent counts are made during the year (if possible supplemented by an assessment of the average number of days or hours work done by irregular helpers) or an assessment is made of the labour input (measured in standard man-days or standard man-years) that would be necessary in order to produce the observed volume of output—and this last measurement, viz. the level of output, raises numerous other problems, both definitional and practical.

c) *Fluidity of sector boundary.* Formally, agriculture is defined as the growing of crops and the raising of livestock, but the economic activity of agriculture necessarily extends to the preparation of produce for sale and to the stage of selling. Thus, the boundary between preparation and sale of farm produce on the one hand, and food processing and distribution on the other, immediately becomes somewhat fluid. Indeed some countries include the value added in bacon-curing and in the manufacture of butter and cheese when calculating the contribution of agriculture to the gross national product; but even apart from this, some functions previously carried out off farms are increasingly performed on farms e.g. grain drying and storage, fruit and vegetable grading and packing. Again, statutory marketing boards and analagous bodies, and farmers' marketing co-operatives could be said to belong, strictly speaking, to the distributive sector, but it would be artificial to exclude them from projections of future training needs in the general field of agriculture.

Similar, though in some ways different, boundary problems occur on the input side of agriculture; and indeed with some forms of vertical integration e.g. broiler production, agriculture may become an intermediate stage between feedingstuffs manufacturing and food pre-packing and distribution. Whilst on the output side, some functions previously performed outside agriculture in the narrow sense are now carried out on farms, on the input side some operations (e.g. ploughing, spraying, harvesting) previously carried out by farm operators with their own labour force are now in some countries increasingly being carried out under contract by specialised landless but highly capitalised firms. In the International Standard Industrial Classification, these contract services are classified as part of a special sub-group within the major group 'Agriculture and livestock production' but such services are not likely to be covered in the agricultural censuses of farm holdings or in industrial censuses of manufacturing establishments. They are nevertheless obviously of great importance in the present context.

d) *Continued importance of manual skills.* It is probably still true of some industries besides agriculture that certain tasks require the judgement and skill that can come, and in part must come, from practice on the job rather than from formal training; and it is undoubtedly true that formal training requirements can be exaggerated in relation to the actual needs of particular jobs. If this were not the case, labour productivity in agriculture would be even lower than it sometimes is. Nevertheless, formal training can mean, and should mean, the accelerated acquisition of skill and judgement both in manpower management and in farm operations. Further, in times of relatively rapid change in production techniques, training for adaptability and retraining of manpower with obsolescent skills is necessary in addition to training the manpower in occupations whose skills do not for the moment change.

e) *Substitutability of training and advice.* When considering the nature and duration of formal training in agriculture, one must consider whether it is more economic to devote resources to raising the general level of training through specialised schooling for all potential farmers, and thus aim to make every farmer his own adviser over a relatively wide range of problems, or to increasing the size of the corps of professional advisers, with greater specialisation within this corps between, for example, production techniques, management problems, and marketing methods. In practice, of course, training and advice are complementary: the efficacy with which advice can be disseminated depends upon the capacity to make use of it by those to whom it is offered, but the problem remains of how much emphasis to place, in allocating resources, on education on the one hand, and on advisory services on the other.

f) '*One farm, one farmer*'. Lastly, one peculiarity of the usual structure of agricultural production may ease the problem of manpower forecasting, at least if only a very broad forecast is needed. This is the corollary of the generally small scale of production units, namely that one farm in principle means one operator, and one operator usually means one farm. Consequently, data from agricultural censuses on the number of holdings may sometimes be used instead of, or to supplement data from population censuses or manpower surveys of the number of operators. Unfortunately the pattern is not always quite so simple: two or more holdings may be managed by one operator, and two or more operators may co-operate in the management of a single holding, whilst land recorded as agricultural holdings may belong to persons whose occupations lie wholly outside agriculture and their land may produce nothing for the market.

III. THE COUNTRY STUDIES

1. THE AGRICULTURAL BACKGROUND

13. The two countries selected for this exercise between them combine some interesting contrasts and similarities. On the one hand France, with its wide

range of climate, is in its southern part typical of other Mediterranean OECD countries whilst in the north, its agriculture is in many ways similar to that of the other non-Scandinavian European members of OECD. The pattern of its output is fairly evenly balanced between crops and livestock products. About a fifth of its total active population is engaged in agriculture, and family labour rather than hired labour is the characteristic form. Agricultural policy aims at raising agricultural output as rapidly as is consistent with market opportunities at home and abroad. In Sweden, on the other hand, largely because of its more limited climatic range, agriculture is characterised by the predominance of milk and livestock products, and is in this respect typical of the other Scandinavian countries. Only about one-tenth of its total labour force is engaged in agriculture, and although hired labour in farming is relatively only slightly more important than in France, there is the more significant difference that in Sweden, part-time work in forestry is usual for very many farm operators and their helpers. In contrast to French policy objectives (and indeed in contrast to those of practically all other OECD countries), Swedish farm policy aims at producing no more than—and, indeed, rather less than—is needed to meet the demand of the home market, and at the present time this implies even a slight reduction in the level of output.

14. Both countries have experienced—in common with most other OECD countries—a continuous decline during the past decade or so in the absolute level of the farm labour force but a rise in the absolute level of the gross product (or value-added) in agriculture, though a less rapid rise than in the gross national product. While the share of agriculture in both the national labour-force and in the national income has declined, the productivity of labour in agriculture (whether measured by value-added per person employed or otherwise) has risen appreciably. This reflects in part the diminishing supply of labour and the consequential substitution of capital for labour, and in part the trend to larger farm sizes and the autonomous introduction of more efficient and more highly capitalised production, processing and marketing techniques in agriculture.

15. The structure of education in general and of agricultural education and training in particular has been undergoing changes recently in both countries, too, and this has not made the task of the country experts any easier when they came to the transformation of manpower projections into educational projections; but since in both countries, the rural population has in the past enjoyed fewer opportunities of benefiting from the type of educational facilities available to urban children and young people, the problem in both France and Sweden consists partly of 'catching up' on vocationally 'under-trained' rural adults.

2. THE MANPOWER PROJECTION METHODS

16. We shall discuss separately the two first steps in the exercise, namely the projection of the components of the total labour force or stock of manpower, and the derivation of the associated annual average inflow of recruits.

a) *The total labour force in agriculture*

17. Because the exercise consists in projecting the number of persons who should have formal training in agricultural subjects, both pilot studies cover not only the labour force in agriculture as narrowly-defined, but also the manpower in those sectors or sub-sectors closely associated with farm production. For

simplicity, we shall call these 'associated activities', and deal with them more fully later. The general classification used in the pilot studies is occupational or functional rather than sectoral, though one could, from a formal point of view, regard it as a classification by occupation or function within sectors or activities.

Agriculture as a 'residual' employer

18. The French study considers the possibilities of projecting the total labour force on farms on the basis either of projections of total farm output, labour productivity per hour and annual number of hours worked, or of projections of the level and structure of total farm output together with work-norms or labour-input requirements, or of the out-migration implied by postulated goals for income per head in agriculture. The French study points out that France is one of the countries where the farm labour force is very largely a residual after other sectors have absorbed what they can, and that consequently labour productivity in agriculture is very largely the consequence of out-migration rather than an autonomous variable. The French national Five Year Plans for the economy as a whole make projections of the total national labour force by economic sector, by broad occupational groups within sectors and by geographical region, and though the projection of the agricultural labour force within those overall projections is in part a residual, some adjustment is made to ensure rough consistency between the derived farm labour-force and the volume of labour likely to be required by the projection of agricultural production targets.

19. The French expert insists that global projections of employment are to be preferred, whenever possible, to sectorial projections: only an overall analysis of employment enables inter-sectorial adjustments to be made. The French pilot study uses the official manpower projection for the farm labour-force for 1970, and derives an approximate forecast for 1980 from a further official projection of agricultural manpower to 1985. For the purpose of subsequent calculations, the French expert explicitly confines his attention to the estimated male component of these labour-force projections, because—he points out—there is less uncertainty about the future trend of this component, and formal agricultural training for girls and women in the farm labour-force differs in emphasis (but not in the academic level aimed at) from the corresponding training of boys and young men. These French projections do not distinguish between farm operators and other male farm labour.

20. The Swedish study makes a clear distinction between operators and other farm labour. This distinction is convenient as well as formally useful: it is convenient in that, by assuming initially that the number of operators at any time is the same as the number of holdings, a general impression of the past trend and future change in the number of operators can be derived from statistics on numbers of holdings, and it is useful in that the kinds of training appropriate for, respectively, operators and other labour are likely to differ. On this assumption of "one farm, one farmer", the following simple equation holds good:

Future total number of operators
= Present total number of holdings
— Number of operators who retire
+ Number of newly recruited operators

Although this is formally an equation for forecasting a 'stock' figure, it involves explicitly two 'flow' figures, namely retirements and recruitment. The intended end-product of the manpower forecast is, however, the annual inflow of recruits, and the above expression cannot be used to derive a forecast of the future manpower stock unless we already know or postulate what we are trying to discover (namely, annual recruitment), or unless we know or postulate the net effect of "retirement *less* recruitment". If we do know or make an initial assumption about this net effect, then we can say:

Future number of operators
= Present number of holdings
— (Retirements–Recruitment)

21. This 'net-effect' term may be estimated by making three kinds of assumption:

i) the initial manpower stock has an even age-distribution;

ii) annual retirements $= \frac{1}{t} \times$ initial stock, where t is the average length of career, and where t may be held constant or may be diminished through time so as to reflect the combined effects of longer formal training and earlier retirement;

iii) a certain fixed or variable proportion of holdings vacated through retirement disappear each year as distinct units, either through combination with other holdings or through withdrawal of their land from agricultural use.

Assumptions on these lines are made in a Swedish model decribed by Ytterborn[1], who then uses the former of the two formulations set out above to project the likely future number of holdings and operators in about 1980 by feeding-in demographic estimates of future retirements of operators, and estimates, based on an assumed decline, of the annual number of new recruits. The model can also be used 'in reverse' to derive the annual flow of recruits needed to bring about a postulated change in the total stock of operators with a given rate of retirement: we return to this in paragraph 40 below.

Agriculture as a semi-autonomous sector

22. In the Swedish pilot study, some projections of the number of holdings are given, based on the assumption that the quinary percentage rate of decline will be the same over the periods 1961-1966, 1966-1971 and 1971-1976 as during the period 1956-1961. In one set of projections, the calculations have been made using a uniform rate of decline for the country as a whole but separately for each of two size-groups of holding; while in a second set—extending to 1981—projections were made separately for each county and for each of a larger number of size -groups of holding. Other projections were made, using the same assumption of constant percentage rates of decline but this time on the basis of the decennial rate in 1950-60 for decennial projections 1960-1970 and 1970-1980, and using data not on holdings (from past agricultural censuses) but on the numbers of persons gainfully employed in agriculture (according to past population censuses).

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[1] G.R. Ytterborn: "*Looking ahead to 1982 in Swedish Agriculture*". FATIS Review 1965, No. 2, pp. 45-51.

23. The Swedish experts go on to explain the limitations of both agricultural censuses and population censuses as sources of basic data for forecasting purposes: the former may not reveal joint operation by two operators and may have to use mailing registers that can never be fully up-to-date; the latter do not cover holders who are not civil persons (e.g. institutions or companies) but would include the hired managers employed by corporate holders and also include persons who describe themselves as holders whether they operate only one or more than one economically distinct holding. The population censuses do, however, provide immensely useful data on age-distributions and (at least in Sweden) on size of holding in the case of civil-person operators.

24. The Swedish study then sets out some very interesting demographic projections using an analysis of figures from the 1950 and 1960 population censuses, showing numbers of farm operators cross-classified by ten-year age-groups and by each of four size-groups of holding. By comparing the numbers in each cell of the 1950 distribution with the numbers in the next-higher age-group of the 1960 distribution, recruitment into and retirement from each age-group can be calculated; *but*—as the Swedish study points out—these recruitment and retirement rates are net rates for each age-group. Almost certainly, some persons will have left agriculture whilst in the age-groups that on balance show a net increase in numbers over the decade, and quite likely a few people will have become operators whilst in the younger of the age-groups that on balance show a net decrease during the decade. This means that both the recruitment figures and the retirement figures are too low.

25. *There is the further qualification*, not mentioned in the study, that the derivation of recruitment and retirement rates from changes in the numbers in age-groups *within size-groups* overlooks the possibility of movement simultaneously between age-groups and *between size-groups*. Let us consider a simple example:

SIZE-GROUPS (HA)	AGE-GROUPS		RECRUITMENT	
	25-34	35-44	APPARENT	REAL
2.1-10.0				
1950	100	—	—	—
1960	—	110(90)	10	20
10.1-20.0				
1950	200	—	—	—
1960	—	220(210)	20	10
2.1-20.0				
1950	300	—	—	—
1960	—	330	30	30

26. The apparent net recruitment of new operators to the first size-group is 10 and to the second size-group is 20, giving a combined total of 30 recruits. But 10 of the 20 new-comers to the size-group 10.1-20.0 ha. may have come from existing operators with holdings at the upper end of the size-group 2.1-10.0 ha. If this is what happened, then the number of operators in 1960 in

the lower size-group would have been 90 existing farmers plus 20 new recruits, and the number of operators in the upper size-group would have been 210 existing operators (of whom 10 who had enlarged their holdings) plus only 10 new recruits. Thus if 'promotion' or 'migration' between size-groups occurs, the number of "apparent" recruits (net) calculated from changes within size-groups is likely to result in a distorted picture of the actual numbers (even on a net basis) of *new* operators entering *each size-group* during the decade, but the *total* number (net) of new operators entering *all size-groups taken together* will be unchanged. This distortion could be of importance if the type of training proposed for new operators differed appreciably from that normally given to existing operators and if there were also differences in the training given to operators of holdings below and above (say) 10 hectares. This problem could be at least partly resolved if data were available on past migration of operators within age-groups between size-groups.

27. The above table also illustrates another problem. If the ten farmers who left the smallest size-group also left agriculture, and if no recruits entered that group, then the totals for all holdings of 2.1-20.0 hectares would show no recruitment at all during the decade—even though there were in fact ten recruits to the size-group 10.1-20.0 hectares. In other words, the number of recruits that can be deduced from decennial changes in the total figures for all size-groups together may be less than the aggregate level of recruitment that could be derived by analysing decennial changes within individual size-groups. It follows that the basic data within age-groups should be divided up into as many sub-groups (e.g. size-groups) as is practicable before the derivation of decennial changes is embarked upon.

28. For the purpose of the Swedish demographic projections, two alternative assumptions were made. First, it was assumed that the same *percentage* decennial rates of net recruitment and net retirement as calculated for the decade 1950-60 (for age groups that showed, respectively, net recruitment or net retirement during that decade) would continue for each age-group during each of the decades 1960-70 and 1970-80, and with the 1950-60 percentage rate of decline in recruitment to the two youngest age-groups for all sizes of holding. Secondly, it was postulated that the same *absolute* decennial recruitment rates of 1950-60 would continue in each of the subsequent two decades for holdings of over 10 ha. for each of those age-groups that showed net recruitment in 1950-60. This second assumption was made because the first resulted in what was judged to be an improbably rapid decline in recruits to the younger age-groups and a consequential over-rapid ageing of the total stock of farm operators. All these calculations were made separately for each of the twenty-four counties and the county results were then aggregated.

29. Lastly, two projections were made on the basis of the expected size and composition of total farm output in 1980 and on the assumption that the labour-input requirements now observed on the most efficient farms become general. One projection excluded and the other included forestry operations associated with Swedish farming. The Swedish experts recognise that these particular projections give minimal figures, simply because the generalisation throughout agriculture of today's best techniques is an optimistic assumption.

30. Whereas the French projections of the farm labour-force explicitly exclude women but implicitly include male helpers as well as farm operators,

the Swedish projections implicitly exclude women (unless they are themselves operators) but explicitly treat helpers—apparently irrespective of sex—separately except in the projections in terms of labour requirements, where the results are in terms of standard man-years of total labour input. This difference in treatment between the two studies of family helpers reflects, in part, the relatively greater importance of family labour in France.

31. The separate Swedish projection of the probable total number of farm workers (as distinct from farm operators) is based rather broadly on the observed percentage fall during 1950-60 in the membership of farm workers' unions and the expectations of those unions and of the agricultural employers' associations.

b) *The total labour force in associated activities*

32. We now come to the increasingly important but poorly-documented field of manpower in activities associated with agriculture. These activities are carried out by the following types of enterprises:

- *i*) Enterprises engaged in the marketing and processing of farm produce, whether of home-produced or imported origin.
- *ii*) Enterprises engaged in the supply of goods and services (including credit) to agriculture.
- *iii*) Research, advisory and information services (including market intelligence agencies).
- *iv*) Agricultural education and training.
- *v*) Professional organisations (e.g. Farmers' Unions, Cooperative Federations, Manufacturers' Associations).
- *vi*) Government services not already covered (e.g. veterinary services, price and income support agencies).

33. The Swedish report quotes some very striking figures showing that in the USA the total number of people engaged in these ancillary activities amounts to over twice the total number engaged in agriculture itself.

34. The French pilot study outlines the following possible approaches to assessing the future manpower needs of these associated activities:

- *i*) Market survey among actual and potential employers.
- *ii*) Investigation of the quantitative relationship within a single country through time between economic growth in agriculture or in the whole economy, and the number of agriculturally qualified graduates and technicians.
- *iii*) Comparison between countries at a point in time (though not necessarily so) of the relationship between e.g. agricultural or national income per head, and the numbers of agricultural graduates and technicians.
- *iv*) Comparisons, either through time or between countries, between the level and structure of farm output and the numbers of agricultural graduates and technicians.

35. The French study itself draws upon the results of a pioneer 'market survey' that asked employers of personnel formally trained in agricultural subjects, covering all of the above six types of enterprise, about their past, present and expected future labour requirements. This survey is described and assessed in some detail in Appendix II. The authors of that survey would be

the first to admit its limitations but it was nevertheless a very useful exploratory exercise. Among the main problems it raised were:

i) incomplete response in an attempt at a full census and the consequent problems of grossing-up and the uncertainty of absolute levels and rates of change;

ii) the inadequacy of an age-distribution for a single year as a basis for estimating future replacement needs;

iii) 'parasitic' recruitment, double-counting, and interpretation of training needs;

iv) the need to provide for training 'autodidacts'.

The Swedish study makes use of more scattered information on the present size and the likely future size of the labour-force with agricultural training employed by the main organisations in the first two types of enterprise listed in paragraph 32, and makes separate projections of the numbers of graduates to cover the senior technical personnel in the remaining types of enterprise; these projections necessarily overlap somewhat with the upper-level component of the projections for enterprises of types (*i*) and (*ii*) in para 32. Before developing these particular projections for graduates, however, the Swedish study suggests a very rough indicator of the likely future number of agricultural graduates-plus-technicians, by using a projection made by the Swedish National Labour Market Board of the number of qualified engineers and technicians per 100 active persons in the industrial sector, and assuming that about the same ratio (namely 7) could be applied to the projected level of the total agricultural active population.

36. The Swedish projections of graduate numbers were made separately for the demand and for the supply. The demand was projected demographically on the basis of expected death and retirement rates among the initial stock of graduates (i.e. the projected replacement need) and postulated increases in the total stock (i.e. the expansion need). The supply projection was also demographic in nature, but starting from the initial stock of students and with postulated increases in admission rates and assumed 'survival rates' to final graduation. By 'confronting' the supply and demand projections, estimates were made of likely shortages if nothing was done to expand the capacity of training facilities.

c) *The annual average inflow of recruits*

37. The transformation of projected increases or decreases in total manpower stocks into equivalent annual flows of recruits is the next stage in the projection exercise.

38. The French study uses two methods for this stage. In the case of the farm labour-force (i.e. operators plus family and paid helpers), it is assumed that since the average length of working life is about 40 years, one-fortieth of the total stock would on average need to be replaced each year. The fact that the total stock is itself expected to decline is taken into account by assuming that during each five-year period 1965-70, 1970-75 and 1975-80, about one-fortieth of the stock *at the end* of each quinary period would need to be replaced: in this way, the average annual inflow itself declines through time. No explicit provision is made for training of the under-trained but some allowance is included implicitly since this method of estimation gives too high a figure for replacements.

39. In the case of the personnel in associated activities, where total manpower is expected to increase, the French study assumes that one-fifth of the five-year cumulative increase in the total stock will on average need to be recruited each year, and because the projected stock increase is itself regarded as on the low side, the annual average inflow has been raised subjectively. In this way, provision is made implicitly (but not explicitly) for replacement needs. Formally, this second French method is identical with the second term of the expression used in the second of the three Swedish methods (see below) modified by a subjective adjustment that implicitly reflects the first term in this Swedish equation.

40. The Swedish study uses three methods. The simplest (which it uses for manpower in the associated activities, for which the basic data are recognised as the least certain) is the same as the first of the two French methods: this we shall call the *terminal rate* of recruitment or K_T equal to: $\left(\frac{\text{Terminal stock}}{t}\right)$ where t = average career length. Secondly, the Swedish experts use a slightly more complicated calaulation that takes account explicitly of (*i*) replacement needs and (*ii*) expansion (or contraction) needs: this calculation uses a slight rearrangement of the simple equation set out in paragraph 20 above:

Future stock of operators
= Present stock of operators
— Cumulative flow of retirement
+ Cumulative flow of recruitment.

Re-arranged, this may be stated thus:

Annual average change in stock of operators
= Annual average flow of retirement
— Annual average flow of recruits

Whence:

Annual recruitment
= Annual retirement
— Annual average stock change

Retirement is assumed to take place evenly at a rate of:

$$\frac{\text{Initial Stock}}{t}$$

where t = average career length, as before. As in the case of K_T, this *average rate* of recruitment (which we shall call $\bar{K}$) postulates an even age-distribution within the total stock of manpower but $\bar{K}$ also implies a constant annual rate of decline in the total number of operators. Further, because $\bar{K}$ is derived from the net change in the manpower stock, it gives net recruitment (i.e. it cannot include recruitment that is off-set by retirement during the period covered by the forecast).

41. An interesting feature of the Swedish calculation of $\bar{K}$ is that t is assumed to be 30 years when this particular expression is used to calculate recruitment of operators, since the average career length of operators (i.e. exercising the function of operator and excluding the estimated 10 years spent as farm helper) is only 30 years. This is a perfectly permissible procedure so long as one bears in mind that this inflow to the stock of operators is an outflow from the stock of non-operator members of the farm labour-force, and that consequently $\bar{K}$ also gives an estimate of this corresponding recruitment flow of 'potential

operators' into the farm labour force. It follows that when estimating the *total* flow into the farm labour force, only that part of this flow which consists of 'career workers' (i.e. those who will not one day become operators) remains to be estimated. If one assumes that their career length is 40 years, then the expression for $\bar{K}$ should be evaluated twice, first with $t=30$ and with labour-force figures for operators only, and secondly with $t=40$ and labour-force figures for 'career workers' only. Alternatively, as the Swedish study points out, one could evaluate the expression for $\bar{K}$ once only with $t=40$, but in this case figures for the total farm labour force (i.e. operators *plus* potential operators *plus* career workers) must be used. This latter approach is the one used in the French study. The identity of the results of these alternative methods is illustrated below:

COMPONENT	TOTAL LABOUR FORCE ('000)	CAREER LENGTH (*years*)	ANNUAL RECRUITMENT ('000)
Operators	150	30	5
Potential operators	50	10	(5)
	200	40	5
Career workers	40	40	1
Total	240	40	6

42. The third method in the Swedish study uses the net recruitment figures derived as a by-product of the demographic projection of the total stock of operators described and commented upon previously (paragraphs 24-28). These we shall call K_D. The assumption of constant 'age-group specific' recruitment and retirement rates resulted, however, in what the Swedish experts judged to be too rapid an ageing of the population of farm operators and an alternative projection was made on the assumption of constant absolute decennial recruitment for holdings over 10 hectares to each birth cohort that experienced net recruitment in 1950-60. As already pointed out, these recruitment figures are under-estimates.

d) *Comparison of the manpower projection methods*

43. It is clear that the actual number of annual recruits needed in the future almost certainly lies between K_T (which assumes complete replacement of wastage from the terminal stock i.e. a future stable labour force) and $\bar{K}$ (which assumes a continuous decline—or a continuous rise—in the labour-force at a constant absolute annual rate). If, however, in the case of a declining labour force the 'stock' figures from which the annual flow is to be derived are themselves known to be too low, then the use of K_T may be permissible as a rough-and-ready correction. This argument can be adduced in favour of the use of K_T by the Swedish study when the future farm labour force is forecast by making optimistic assumptions about future levels of productivity per head. Similarly, in the case of a rising labour force, the use of K_T may be permissible either as a rough correction for stock figures that are thought to be too high, or as a means of obtaining a minimal estimate of annual recruitment needs. The use of $\bar{K}$ rather than K_T would compensate (roughly) for too-high a projected terminal stock in the case of a falling labour force, and for too-low a projected stock in the case of a rising labour force. In illustrating the use of the expression for $\bar{K}$, the

Swedish study points out that this type of estimate gives some automatic compensation for projections of future numbers of holdings that are probably too high.

44. It seems *prima facie* reasonable to accept K_D as the most plausible estimate since it reflects the actual age structure of the present population and therefore reflects also the changes that must occur in the size of age-groups in future years on the assumption that recruitment and retirement rates continue unchanged or change in postulated ways. One must however bear in mind the limitations of this estimate that have already been discussed, namely that recruitment offset by retirement within age-groups, and promotion between farm size-groups, cannot be included.

45. The relationship between the terminal (K_T) and the average ($\bar{R}$) rates of recruitment is investigated more formally in Appendix III and the results of this analysis are illustrated in Graphs 1 to 4[1]. The first two of these show that the extent of overstatement of the annual number of recruits obtained by K_T compared with $\bar{R}$ increases rapidly as the rate of decline in the total manpower stock increases, and that for a given percentage fall in the total stock, the ratio of K_T to $\bar{R}$ is greater for a 10-year forecast than for a 20-year forecast. Thus for a 25% fall in the labour force over a 20-year period, K_T is about 1.2 times $\bar{R}$ but for the same percentage fall over a 10-year period, K_T is about 3.0 times $\bar{R}$.

46. It should be pointed out that for analytical convenience the higher estimate (K_T) has been considered as a proportion of the lower ($\bar{R}$), but this is not intended to imply that $\bar{R}$ is necessarily the better of the two estimates. As has already been stated, $\bar{R}$ is almost certainly too low in the case of a declining population.

47. Graph 2 illustrates a situation that is not obvious from Graph 1, namely that $\bar{R}$ may actually indicate a negative number of 'recruits' each year although K_T indicates a positive inflow. This is not entirely surprising when one recalls the expression for $\bar{R}$ namely:

$$\bar{R} = \frac{P_0}{t} - \frac{P_0 - P_1}{u}$$

A situation may arise in which the second term on the right-hand side (viz. the annual average decline in the total manpower stock) exceeds the first right-hand term (viz. the apparent annual average number of replacements for retirements and other losses). For a 10-year forecast, this situation could occur if the labour force was expected to be rather more than 30%.

48. Graphs 1 and 2 also show that not only is $\bar{R}$ greater than K_T (i.e. $K_T/\bar{R}$ is less than unity) when the total labour force increases, but also that the relative gap between the two alternative estimates of annual recruitment varies much less for different rates of *increase* of the labour force than for different rates of *decrease* of that manpower stock.

49. Graphs 3 and 4 compare the absolute levels of the alternative estimates of annual recruitment to achieve a postulated decline in the total number of farm operators between 1950 and 1980. The manpower stock figures are taken from the Swedish pilot study rather than from the French study because demographic estimates are available for the former but not the latter. The first of

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[1] See Appendix III.

these graphs relates to all holdings over 2 hectares and the second to holdings over 10 hectares.

50. In the case of operators on holdings over 2 hectares, the decennial percentage rates of decline implied by the forecasts vary between 32% and 36%, and (as Graph 2 leads us to expect) the relative gap between K_T and $\bar{K}$ is very considerable. Indeed for the decade 1970-1980, we have the situation where K_T indicates an actual out-flow, over and above losses through retirements and other wastage, of nearly 300 per year. For operators on holdings over 10 hectares, the decennial percentage rates of decline implied by the forecasts are much lower, namely 12%-23% and the gap between K_T and $\bar{K}$ is consequently much less.

51. Graphs 3 and 4 also show K_D in relation to K_T and $\bar{K}$. This relationship is to a large extent determined by the adequacy (or inadequacy) with which the retirement rate is estimated by the quotients P_1/t or P_0/t (in the expressions for K_T and $\bar{K}$ respectively). Examination of the age-group structure of the demographic forecasts shows that in 1960, the 55-64 age-group comprised about 28% of all operators on holdings over 2 ha., whereas the recruitment rates estimated from K_T and $\bar{K}$ implied retirement of about one-thirtieth of the labour force each year or about 33% in a decade. It follows that not only is K_T too high but even $\bar{K}$ *may* give too high a figure. A comparison of the percentages just quoted shows that the extent of the *under*-estimation by $\bar{K}$ is certainly diminished by the *over*-estimation of the replacement component in the expression for $\bar{K}$, particularly in the case of operators on holdings over 10 ha. This phenomenon is reflected in the closeness of $\bar{K}$ to K_D in Graph 4, which shows $\bar{K}$ actually above K_D during 1950-60 and 1960-70.

52. In view of the liklihood that demographic data on the farm labour-force (and on the labour-force in ancillary activities) will often be unavailable, an approximation to K_D may be obtained by taking the simple mean ($\bar{\bar{K}}$) of K_T and $\bar{K}$. As is shown in Appendix III, this mean can be computed directly from K_T and the proportionate fall (p) in the total labour-force over the forecast period. If this period is 10 years and we assume (as before) an average working life of 30 years for farm operators, then

$$\bar{\bar{K}} = K_T\left(\frac{2p-1}{p}\right)$$

and corresponding expressions may be derived for other career-lengths and forecast periods.

53. A possible refinement, if demographic data are available for a recent past period, is to compute $\bar{\bar{K}}$ for that period and to use the ratio $K_D/\bar{\bar{K}}$ for that period as a constant factor for adjusting forecast values of $\bar{\bar{K}}$ for subsequent periods. The results of such an adjustment are also illustrated in Graphs 3 and 4.

54. It would seem highly desirable to base projections on demographic material where this is available, but otherwise to estimate $\bar{\bar{K}}$ rather than K_T. When demographic data are available they should be analysed separately for different size-groups of holding if this is possible.

3. TRANSFORMATION OF MANPOWER PROJECTIONS INTO EDUCATIONAL PROJECTIONS

55. As was pointed out previously, the transformation of the manpower projection into an educational projection may be made on the basis either of the

manpower stock (i.e. total labour force), or of the corresponding manpower flow (i.e. annual recruitment to the labour force). The approach used depends largely on the available basic data: if census or sample survey data on the educational levels of the relevant parts of the total labour force are available, then it will probably be convenient to consider the educational levels of the projected total labour force and to derive the corresponding recruitment flows (by educational level) from these latter stock figures. If, on the other hand, the educational composition of the present labour force is estimated from past figures of the annual outflow from schools and colleges, then it may be convenient to estimate directly the educational composition of the projected annual flow of recruits to the labour force.

56. Both the two pilot studies draw attention to the paucity of data on the level of training of the labour force in agriculture and in associated activities, though the French study gives some very interesting figures obtained through the *ad hoc* survey by APECITA among employers of 'cadre' personnel.[1] The French study itself makes two types of flow estimate: the one is derived from the APECITA estimates of employers' own total future stock of cadre staff classified by level of training, and the other is a direct estimate of the annual flow, by educational level, into the farm labour-force on the assumption that the proportionate split between the two levels observed for the recent past will move towards a larger proportion at the higher level of schooling.

57. The Swedish study considers two educational analyses of projected manpower stocks and derives from each the corresponding recruitment flows by educational level. The first stock analysis postulates that on every holding of over 50 hectares, there should be at least one qualified technician, and the second analysis estimates rather more subjectively the type and level of formal training needed for some of the more clearly definable occupations in the activities ancillary to agriculture. Thus, for example, persons working with firms that sell farm requisites or that buy farm produce should have a good knowledge of the principles of farm production, whereas the training of employees in credit agencies should clearly give primary emphasis to commercial principles but should equally clearly also include some instruction in the principles of agriculture.

58. The actual methods used in the two country studies for estimating the annual recruitment flows from projected manpower stocks have already been discussed. The Swedish study of the future needs for agricultural graduates at university level is, however, of additional interest in that it 'confronts' independent projections of demand (made in the manner described earlier) and of supply. The supply projection method will be considered in the next section.

4. ESTIMATION OF STUDENT NUMBERS AND PLACE NEEDS

a) *Derivation of stocks from flows*

59. The ultimate objective of educational planning of the present type is to arrive at reasonable estimates of the volume of resources, in terms of buildings, equipment and staff, needed to produce the annual outflow of qualified personnel that will provide the projected annual inflow of recruits to agriculture and its associated activities. (This distinction between outflow from the training

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[1] Some of the more important problems raised by this survey are discussed in Appendix II.

system and inflow to the labour force is necessary since not all those who receive the appropriate training in fact enter the job for which they have been equipped.)

60. There is therefore now a second problem of relating stocks and flows: at this stage, the problem is that of deriving stocks (viz. students on roll) from flows (viz. annual numbers of school-leavers or 'graduates'[1]). This 'reverse' calculation—i.e. the reverse of the original type of calculation, which was to derive annual flow figures from total labour-force stock figures—illustrates further the key importance of the length of time spent by a unit in the stock as determining the relationship between the manpower stock and its annual inflows or outflows. The possibility of obtaining mutually consistent flow estimates by using alternative working-life durations *and* different labour-force concepts has already been demonstrated once in the case of the Swedish calculations with alternative career-lengths of 30 or 40 years for different categories of manpower.

61. In the case of the French study, attention is concentrated upon formal school education up to the end of the 'long secondary' course. The Swedish study, on the other hand, considers primarily the needs for vocational training at the post-secondary stage. Consequently, in the French study, the total numbers of pupils for whom there should be teaching facilities is built-up from three elements, namely (*i*) the postulated annual output at each of two levels of schooling, (*ii*) assumed net drop-out rates[2], and (*iii*) the number of years needed to complete each course. In the Swedish case, since all the courses last at most one year, and many of the courses last only about six months, the total number of pupils attending training in any year and the total output of the training system in that year are the same.

62. This particular simplification is, however, offset by a complication that arises precisely because a large proportion of the vocational trainees attend courses that last less than a year and that, in some cases, can be run consecutively rather than simultaneously. This means that the total number of school places required (and consequently the size of school buildings, the quantity of school equipment and the number of teaching staff) may be less than that implied by the total annual number of trainees.

63. In this situation the relationship between the required number of school places and the postulated annual output of trained pupils depends on the distribution of pupils between courses of different durations and calendar-dates, and the number of teaching staff in relation to a given total number of pupils depends on the same two distributions. In the Swedish study, projections of school-place needs and the corresponding requirements for teaching staff are made on the alternative bases of (*i*) continuation of the current pattern of course attendance and (*ii*) a move towards a higher proportion of trainees in the higher-level courses. These relationships between pupils, places and teachers are expressed in the convenient form of "requirements per 100 pupils in basic courses".

64. When these ratios are used to evaluate absolute requirements at the end of the projection period, two further alternative assumptions are made about

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[1] See footnote to paragraph 9.

[2] The number of pupils in a given class in year 2 equals the number of pupils in the preceding class in year 1 *less* those who for some reason do not move up one class *plus* the number who were in the given class in year 1 but who remain for a further year's study.

the total numbers seeking training. The first assumes that all those who, according to the projections, ought to be trained actually seek and obtain training; the second assumes that only 75% of this number ask for training. (This second assumption is equivalent to a third alternative, namely that all who need training seek it, but for financial or other reasons only 75% of this number can be offered training).

b) '*Dynamic*' and '*Static*' models

65. The Swedish projection of the supply of university graduates is made by using a model of university flows and stocks that is, in form, a dynamic version of the static model used in the French study to estimate the size and structure of the population in agricultural secondary schools at a single point in time. The French 'demand' model begins from the postulated output from the school system and builds up the implied stock of pupils in school. The Swedish 'supply' model starts from annual admissions and builds up the resulting stock of students and the annual outflow of graduates on stated assumptions about the year-to-year transition rate and the final drop-out rate.

66. Although the French static model is based on projected demand and the Swedish dynamic model is used to project supply, the static model could have been used to project the supply of school leavers on the basis of class-to-class transition rates and either total school population or annual new enrolments; similarly, the dynamic model could have been used to project the annual enrolments and total student numbers implied by a postulated demand for university graduates. In the dynamic model, the effects of changes through time in the assumptions about annual new admissions, repetitions and drop-out can be studied. In the static model, the effect of different assumptions about transition rates on school place-needs at either end of the training period can be observed.

67. Repeated application of the static analysis, with constant or varying transition rates, will of course generate an expanded version of the dynamic model, and such an expanded analysis would be even more useful than either of the two existing models. In an expanded analysis, the progress of specific cohorts of new admissions through the training system could be observed. The table illustrates how such a cohort analysis could be laid-out. The first example uses the French figures (rounded), and assumes that no pupil repeats any year of study. The second example shows how—given adequate data or plausible assumptions—the separate and combines effects of 'repeating' and drop-out influence the relationship between annual new admissions, the numbers in each form, the total numbers on roll and annual graduations. (For simplicity, constant annual rates have been used in both examples.)[1]

5. ESTIMATION OF FINANCIAL COSTS

68. This stage of the calculations is relatively straightforward, methodologically speaking. The two country studies set out such basic data as are available, and the Swedish study goes on to work out the annual average capital and

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[1] The use of input-output flow tables covering a single pair of years as a method of measuring repetition, drop-out and transition rates is described and discussed in the *Handbook of Statistical Needs for Educational Investment Planning*, OECD, Paris (1966).

EXAMPLE	FORM / YEAR	THIRD			FOURTH			FIFTH		
		NEW ADMISSIONS	REPEATS	DROPOUT	DIRECT	REPEATS	DROPOUT	DIRECT	REPEATS	DROP
	YEAR	1	2	3	4	5	6	7	8	9
I	1	11.6								
	2	11.6	—	0.6	11.0					
	3	11.6	—	0.6	11.0	—	0.5	10.5		
	4	11.6	—	0.6	11.0	—	0.5	10.5	—	0.
	5	11.6	—	0.6	11.0	—	0.5	10.5	—	0.
	6	11.6	—	0.6	11.0	—	0.5	10.5	—	0.
			—	0.6	11.0	—	0.5	10.5	—	0.
						—	0.5	10.5	—	0.
									—	0.
II	1	12								
	2	12	2	1	9					
	3	12	2	1	11	2	1	6		
	4	12	2	1	11	2	1	10	2	1
	5		2	1	11	2	1	10	2	1
	6							10	2	1
	7									
	8									
	–									
	n	12	2	1	11	2	1	10	2	1

Notes on calculations:

Col 1: New admissions

Cols 2, 5, 8, 11 and 14: Pupils who repeat in year $t+1$ the studies they attempted in year t

Cols 3 6, 9, 12 and 15: Pupils who begin a course in year t but who do not continue school into year $t+1$

Cols 4, 7, 10 and 13: Pupils who advance from form F in year t to Form F+1 in year $t+1$ (including those 'repeating' pupils who repeated in Form F in year t the course they had already attended in form F in year $t-1$).

current costs, for teaching staff and other elements, for each of four alternative combinations of hypotheses about student numbers and about the distribution of students between different types and duration of course.

6. CONCLUDING REMARKS

69. It was pointed out at the beginning of this chapter that, whilst attempting to summarise and analyse the various stages in the calculations set out in the two pilot studies, attention would "be focussed on those parts... which are of greatest methodological interest". This fact explains the necessarily unequal amounts of space devoted to each of the several stages in the exercise. In order to restore the balance, and to assist readers in locating the relevant parts of the country experts' reports, a tabular summary at the end of this chapter sets out, for each main step of the projections, a short description of the estimation methods used (or that, if adequate data were available, could be used) and of possible sources of suitable data. This summary table itself over-simplifies things, and sometimes forces into a rather rigid pattern some elements that, in the original pilot studies, were not presented in precisely the manner suggested by the table.

COHORT ANALYSIS

Thousands of pupils

SIXTH			TERMINAL			GRADUATES	NUMBERS ON ROLL		
IRECT	REPEATS	DROPOUT	DIRECT	REPEATS	DROPOUT		DIRECT	REPEATS	TOTAL
10	11	12	13	14	15	16	17	18	19
10.0									
10.0	—	0.5	9.5						
10.0	—	0.5	9.5	—	0.5	9.0	52.6	—	52.6
10.0	—	0.5	9.5	—	0.5	9.0			
10.0	—	0.5	9.5	—	0.5	9.0			
10.0	—	0.5	9.5	—	0.5	9.0			
	—	0.5	9.5	—	0.5	9.0			
				—	0.5	9.0			
3									
9	2	1	—	—	—	—			
9	2	1	—	—	—	8			
9	2	1	—	—	—	8			
			—	—	—	8			
9	2	1	—	—	—	8	42	8	50

Col 16: Pupils who successfully complete the course (including those who repeat).
Cols 17 and 18: Sums of numbers in corresponding "Form" columns.
Col 19: Col 17 + Col 18

Further, because this table aims at pin-pointing the problems in calculation, it deliberately ignores the no-less-important problem of assessing the desirable balance between different types and duration of training.

70. Other problems not discussed but that should not be overlooked are those arising from the need for consistency between any national synthesis of regional estimates on the one hand and overall national estimates on the other, and the need to investigate the implications of other levels and rates of change for parameters (e.g. career-length, recruitment and retirement rates, distribution of students among courses) than the particular values assumed in the present country studies.

71. Finally, this synoptic table does not pretend to be either an exhaustive summary of all possible projection methods or data sources, nor to contain references to every single point touched on in the two pilot studies. It is nevertheless hoped that both the present chapter and the synoptic table will help readers to adapt the methods covered to their own particular problems, and will stimulate further thought in this important but almost completely uncharted field.

IV. SUMMARY OF PROJECTI

STEP	METHOD
Total Labour Force-Agriculture	Direct extrapolation of past trends in agriculture of labour for and/or number of holdings Construction of over-all supply and utilisation table for the to labour force, based on trends in total active population, pr duction, hourly labour productivity, duration of working wee sectoral composition of output Derivation from projection of agricultural output level a composition, and assumptions about labour input requiremen or farm income objectives Demographic analysis of changes in the farm labour force, a derivation of the consequential size of the future labour for by making assumptions about continuity of (or changes i past recruitment rates and retirement rates
Associated activities	Direct extrapolation of past trends
	Derivation from trends in ratios of personnel to sector outp or to total active population, together with correspondi aggregates (viz sector output, or total active population) Comparison of 'encadrement' ratios between countries Enquiry among employers of their expected needs
University graduates	Derivation from trends in 'graduate' ratios, as above. Enqui among employers, as above. Derivation from new enrolmen course length and 'drop-out' rates
Annual recruitment to the labour force	Terminal rate, derived from end-of-period total labour force, a assumptions of even age-spread and complete replaceme after postulated career-length Average rate, derived from beginning-of-period total labo force, and assumptions of even age-spread and even annu change in total number during forecast period Derivation from demographic analysis of initial labour-forc and assumptions about retirement rates and recruitment duri the period
Educational levels	Analysis of present total labour force by educational level, a estimation of desirable composition of projected labour for Synthesis of educational composition of labour force by cons dering past and future outflow from the educational syste into the relevant occupations, and with assumptions abo wastage

ETHODS AND DATA SOURCES

SOURCES	PARAGRAPH REFERENCE	
	FRANCE	SWEDEN
opulation census; Agricultural census, or other manpower or employment surveys		69-80 109-111
ational economic development plans, or in their absence, interpretation of government policy objectives on the basis of available statistical data in population censuses, and in reports on gross domestic product by industry of origin, and on labour force by sector, industry or occupation	53-70	
gricultural statistics on past figures. Ad hoc reports on labour requirements. Interpretation of government objectives for farm income levels and/or relationships	63	112-121 124-134
opulation census, Agricultural census, *ad hoc* "matching" of returns from these two censuses and/or from registers held by farmers' organisations		92-108
opulation census. Employment data from censuses of production and/or distribution. Registers of trade associations, trade unions.		136-145 163-169
egisters of schools and colleges; old pupils' societies	83	
pecial surveys of employment by sector, industry and occupation	82-83	
elevant sources from among those named above	84	152-154
Ditto	84	
d hoc survey through professional bodies or other channels	85-87 Annex I	164
elevant sources from among those named above niversity admissions and graduations	84-87	149-154 155-162
otal labour force projections, as above	71	109-111 122-123 135 145-148
	84-87	81-91
		92-101
opulation and/or agricultural censuses. Special enquiries	32-41 46-50	33-44
tatistics on student population, school-leavers and university graduates, supplemented by data on occupations entered.	42-44 72-81	34-35 44 155 156-162
pecial enquiries		36-40

SUMMARY OF PROJECTION METHO

STEP	METHOD
Educational levels (continued).....	Postulation of training needed for different occupations and/ sizes of holding Enquiry among employers of their expected needs Analysis of present school population by socio-economic and/ geographic origin, and making assumptions about subseque occupations Comparison with broadly similar countries for which statisti are available
Annual new enrolments to training institutions....................	Derivation from required annual output of graduates, assum tions about class to class transition rates and dropout befo final graduation, and total duration of training
Total numbers in training institutions..........................	Derivation from postulated output or input, and assumptio about drop-out rates and duration of training
Total numbers and places.........	Analysis of distribution of students between courses

ND DATA SOURCES (*continued*)

SOURCES	PARAGRAPH REFERENCE	
	FRANCE	SWEDEN
ubjective estimates applied to relevant manpower and/or holdings statistics		138-150 166
pecial enquiry through professional bodies or other channels	35-41 86	
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CONCLUSIONS AND RECOMMENDATIONS

I. INTRODUCTION

1. The preceding parts of this report have been contributed by individuals or by groups of individuals. Whilst a large measure of agreement on the principles and methods used exists between all the participants in this exercise, formally the content of each of the previous parts remains the responsibility of the respective authors. The present chapter sets out unanimously agreed conclusions and recommendations.

2. Both the country studies repeatedly draw attention to the inadequacy of basic statistical data, and the differences in the approaches used in the pilot studies reflect partly the differences between countries in the availability of basic information. Although future methodological work may possibly show that some types of data are of much greater importance than others, the following paragraphs make proposals for remedying all of the main data deficiencies revealed by the present exercise. Because, however, of the complexity of many of the problems involved, the recommendations point out the basic needs and some possible solutions, rather than offer unique solutions in all cases. Much further work remains to be done both nationally and internationally before all these practical problems can be satisfactorily resolved.

3. The basic justification for attempting to judge the need for training of different kinds, and the numbers of persons who should receive one or more of several types of training, is that complex modern societies depend for their well-being on a continuous supply of citizens able to make competent contributions to the myriad economic and social activities of the community; and precisely because competence is imparted largely (but not wholly) through formal training and because that training takes something like 10 years from start to 'finish', the desired output from the training system at any time will not be obtained if proper provision has not been made to receive and teach the input up to ten years previously. This formulation of the basic problem is intended to be broad enough to include social or cultural objectives as well as more narrowly economic objectives as part of educational planning.

4. If an attempt to assess the size of the educational needs of a community is justified at all, then the attempt must be made separately for each of its major economic sectors. Though, however, these sectoral estimates may be built up separately, they must necessarily at some stage be tested for mutual consistency. It follows that educational planning in agriculture (and its associated activities) should be regarded as a necessary part of the whole educational exercise: agriculture has its own special features that call for particular attention, but it also has many of the characteristics and problems of other sectors of the economy. Those responsible for planning education and training in agriculture

should not be led by agriculture's peculiarities into isolating their work from the mainstream of thought and work in educational planning in general.

5. There are two further important reasons for the need of a 'dialogue' between planners of agricultural education and other groups: depending upon the levels aimed at and the syllabus content in agricultural training, this training depends to varying degrees upon the general education system; and precisely because all non-compulsory training depends so much upon the interest of those who do or 'should' seek it, there should be a dialogue between the educational planners and the organisations in which the actual or potential beneficiaries of non-compulsory training work.

II. GENERAL CONCLUSIONS

6. Without in any way attempting to advocate the maintenance or expansion of uneconomic agriculture or to exaggerate the importance of specifically agricultural education and training within the general framework of educational planning, one must recognise that other sectors of the economy are often better able than agriculture to present their views on educational policy convincingly to governments precisely because those sectors have better basic data about their present structure and their future expectations. It is essential that the agricultural sector be enabled to recognise its own weaknesses and to work out its own needs as objectively as possible. With this aim in view, the following conclusions are inescapable:

i) The present lack of statistics on education in rural communities should be remedied and an international framework should be set up for collecting comparable statistics on a country-by-country basis; the OECD should examine the possibility of publishing regular series of statistics on 'intellectual investment' in agriculture and these should be as detailed as possible.

ii) Improved methods should be developed for forecasting the demand for graduates and technicians with agricultural training. This is at present the weakest point in the planning of agricultural vocational and technical training.

iii) Methods should be devised for estimating the productivity of agricultural training and more generally, for assessing the agricultural implications of alternative budgetary proposals for agricultural education in order to guide those who must make the decisions.

III. NATIONAL STATISTICS

7. The general adoption by countries of the following recommendations would improve materially the quantity and quality of the essential data for educational planning in agriculture:

i) The terminology used in successive enquiries (e.g. censuses) should as far as possible be uniform and definitions should be unambigous. Where it is essential to change definitions between enquiries, the relationship between the old and the new concepts should be stated clearly, and if possible some quantitative indication should be given on how to relate the new data to the old series.

ii) Classification criteria should be refined to gain comparability between different data sources (e.g. between agricultural censuses, population censuses and employment statistics).

iii) Censuses of agriculture should be based on registers which are kept up-to-date. This is particularly important when such censuses are taken less often than annually.

iv) Continuous official statistics should be collected and published on the number of farm operators (distinguishing, where possible, hired managers), foremen and other employees in agriculture, distinguishing between regular full-time workers and other workers.

v) In those countries where forestry is significant, continuous statistics should be collected and published on the labour input to forestry by the agricultural population.

vi) Official statistics should be collected and published on educational levels in agriculture.

vii) Official statistical series should be introduced on the educational levels of those engaged in activities related to agriculture (e.g. agricultural contract services, supply of agricultural requisites, marketing and processing of agricultural products, and the relevant government and professional bodies).

IV. BASIC REQUIREMENTS

8. Most countries already publish some statistics on the labour force in agriculture and on the total labour force in the whole economy, but the amount of detail and the frequency of publication are very often inadequate for educational planning. The main essential types of statistic needed for this purpose are set out below. Ideally, these statistics should be collected and published annually, but if this is not possible, they should be available for decennial census years and at 5-yearly intervals in between census years.

1. MANPOWER IN AGRICULTURE

a) The following *minimal categories* should be distinguished:

- i) *Operators*—These will generally be covered by the category "Employers or persons working on own account" if this is used in official manpower statistics[1], but on larger-sized holdings in some countries, salaried managers may perform all the functions of an operator, and published statistics should make clear how salaried managers are treated.
- ii) *Unpaid family workers*—In some countries, paid (as well as unpaid) family workers may be of importance, and their treatment in published statistics should be made clear.

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[1] See, for example, *OECD Agricultural and Food Statistics 1952-1963* and *OECD Manpower Statistics 1954-1964*.

iii) *Wage earners and salaried employees*—See remarks to (*i*) and (*ii*) above.

b) In addition, separate figures should be given for *males* and for *females*.

c) For any attempt to analyse the pattern of recruitment and retirement, separate data should be collected on at least the *age groups* 'Under 20', '20-64' and '65 and over'; and serious consideration should be given to the possibility of obtaining data five-yearly on the quinary groups 'Under 15', '15-19', '20-24' ... '55-59', '60-64' and '65 and over'[2].

d) In order to understand better the *volume of work* implied by a given number of persons in the labour force, the following categories should also be distinguished:

i) *Regular workers*—These may sometimes be designated as 'permanent' workers. The criteria used in defining them should be made clear[2].

ii) *Other Workers*— These may in some statistics be further sub-divided into 'temporary' and 'occasional' workers. Here again, the precise definition should always accompany published figures.

For all categories distinguished, meaningful use of the figures would be facilitated if some indication could be given of the average annual number of hours of farm-work performed per head in each category. Where forestry work by the farm labour-force is significant, data on hours worked per year in forestry should also be given.

e) It is essential to have at least the distribution of manpower according to *area of 'employing' holding* in order to obtain a minimal impression of the relationship between farm structure and manpower, but this is insufficient by itself as a guide to training needs. In addition, statistics should be obtained on the distribution of the labour force by *pattern of production* of the holdings upon which engaged (as indicated by e.g. the relative importance of crops and of livestock in farm production or output). If this distribution cannot be derived directly, then a detailed occupational breakdown of the labour force is essential (see (*f*) below).

f) Some sub-division of the labour-force by *occupation, function* or *level of responsibility* is essential. This could be a classification between:

i) Farm operators (including farm managers)
ii) Farm workers—Supervisory
    Other—
        Skilled (or specialised)
        Semi-skilled
        Unskilled

or between (*i*) Supervisory and (*ii*) Other. This latter distinction would not be

---

1. It is already proposed in OECD Manpower Statistics to collect and publish data on the *total* labour force separately for the age groups 'Under 20', '20-64' and '65 and over' and for as many intermediate groups within the middle range as can be completed by available national data. The *Programme for the 1970 World Census of Agriculture* proposes that the age-groups 'Under 15', '15-64' and '65 and over' be distinguished. For operators, it proposes decennial age-groups between 35 and 64 years. The EEC proposals for a Farm Structure Survey envisage collecting year-of-birth for all members of the regular farm labour force and for all family labour in the sample.

2. The FAO 1970 World Census programme distinguishes between 'Permanent', 'Temporary' and 'Occasional' workers. The EEC Structure Survey will distinguish between 'Regular', and 'Irregular' Workers.

entirely satisfactory in that highly skilled and specialised workers may not themselves exercise any supervisory responsibility. A classification by occupation is ordinarily used in general population censuses[1] and whilst the results of such a classification would be very useful, it would be even more so if a cross-classification with relevant information on farm size or structure from a simultaneous (or near-simultaneous) agricultural census could be obtained. An occupational analysis of the farm labour-force is more necessary if the information on the output pattern of farms is very limited. Conversely, the greater the detail that is available on the pattern of output, the less essential is a *detailed* analysis by occupation, but a *minimal* analysis by function is in any case essential.

g) The *educational level* of the labour force could in principle be assessed according to one or more of four criteria namely:

i) Highest level of training completed
ii) Certificates obtained
iii) Number of years spent in full-time training or
iv) Age at end of full-time training[2].

In practice, some of these criteria are sometimes inappropriate: thus it may be difficult to compare the relative level of courses of different duration or subject-matter, and intermittent full-time training (e.g. Winter schools) could not be adequately assessed by criterion (*iv*). A combination of criteria (*i*) and (*ii*), supplemented by data on types of course attended if certificates are not issued, would seem to be the most meaningful basis for the collection of data on agricultural training[3]. Such data could then be expressed in terms of the total duration of training, on the basis of the duration of the various courses concerned. It would also be useful to know about the general (i.e. not specifically agricultural) education of the farm below force: this would give some further indication of the 'quality' of the totality of training received.

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[1] The International Standard Classification of Occupations distinguishes between 'Farmers and farm managers' and 'Farm workers' and, within these two groupes, between the following (among other types of farmer and farm worker):

- Farmer—General
  - Crops (general)
  - Grain and feed grasses
  - Vegetable
  - Fruit and nut trees
- Farm Hand—General
  - Crops
  - Livestock
- Farmer—Livestock (general)
  - Beef cattle
  - Dairy
  - Sheep
  - Pig
  - Poultry
- Operator, farm equipment
  - Motor drawn
  - Animal drawn
- Farm labourer

[2] These four criteria are set out and discussed in the context of general educational planning, in the OECD "*Handbook of Statistical Needs for Educational Investment Planning*". The Handbook recommends 'duration of training' as the most suitable measure of the 'quantity' of educational effort whilst recognising that this criterion can take no account of the accompanying 'quality'; this could—the *Handbook* suggests—be at least partly assessed by asking also about level reached and certificates obtained.

[3] The FAO 1970 World Census (European Programme) proposes that the highest level of agricultural education received should be recorded with sub-divisions of each level according to main type of course (e.g. winter school).
Unfortunately, this programme only provides for the collection of this information in respect of holders and members of their household. The EEC Structure Survey also proposes asking about the highest level of agricultural training, but of the farm operator only, from among 'None', Primary, Secondary and University levels. See also OECD *Documentation Series in Agriculture and Food*, No. 52.

h) *Supplementary data* of the following types should be obtained whenever possible:

- *i*) Cross-classifications of the above characteristics
  - e.g. Function classified by Age
  - Function classified by Education
  - Type of worker classified by Size of holding
- *ii*) Age at which helpers become operators
- *iii*) Ages at which operators retire from active management, and from all farm work, respectively
- *iv*) Abandonment of agriculture below normal retirement age
- *v*) Movement between different size-groups of holding
- *vi*) Nature of use of land vacated on death, retirement or for other reasons
- *vii*) Nature of employment of school- and college-leavers: First job, job after five years, job after ten years
- *viii*) Extent to which 'less-than-full-time' workers divide their time between two or more farms and in fact work full-time.

2. MANPOWER IN ANCILLARY ACTIVITIES

a) The primary need here is to be able to distinguish within any general classification of manpower by *economic activities* those branches that are partly or wholly ancillary to agriculture. The customary type of analysis that distinguishes "Food manufacturing" and "Beverages" within the broader group "Manufacturing"[1] is useful but insufficient. It is also necessary to distinguish e.g. non-cereal animal feedingstuffs (such as oilcakes and meals) and fertilisers, but these are likely to be 'lost' in 'Manufacture of chemicals and chemical products' unless special arrangements are made to isolate the relevant information[2]. Similarly, the marketing of agricultural products is likely to be at least partly 'lost' in the broad group "Commerce" or "Wholesale and retail trade" unless steps are taken to distinguish the necessary data; and the supply of agricultural machinery and equipment is (unless special steps are taken) likely to be 'lost' in "Manufacturing".

The assembly of separate data on manpower engaged in the relevant parts of the Government sector (e.g. advisory and veterinary services) should present fewer problems though it would be desirable to treat "Education" as a separate sector[3]. There remains the need to obtain information on manpower employed by professional bodies concerned with agriculture and food.

To summarise, one possible classification[4] would be:

- *i*) Industries processing and marketing agricultural products
- *ii*) Industries supplying agricultural equipment and requisites
- *iii*) Other services to agriculture—
  - Research, advice and information

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[1] See, for example, the International Standard Industrial Classification.

[2] An attempt has been made to collect separate data on these particular sub-branches of the chemicals industry in an enquiry on 'Research and Development in Agriculture' carried out by the Technical Action Division of the OECD Agricultural Directorate.

[3] The OECD "*Proposed Standard Practice for Surveys of Research and Development*" distinguishes the four sectors 'Business enterprise', 'General government', 'Private non-profit' and 'Higher Education'. As pointed out above, these are not entirely satisfactory for the present purpose.

[4] See, for example, "Suggested Analysis of Graduates and Technicians" proposed by Professor Malassis in Appendix I of the present report.

Education and training
Professional organisations
Other

A classification on these lines could be integrated with the usual broader analysis of the national economy between the Business enterprise, Government (excluding Education), Private non-profit institution, and Education sectors.

Because of the wide range of occupations or functions covered by these economic branches, and the overlaps between them (e.g. research is carried out by manufacturing industries, and advive is given by processing industries), a cross-classification of manpower, *between functions within industries* is also necessary. Possible functional break-downs are considered below.

b) Just as in the case of the agricultural labour force, so also in the case of the labour force in ancillary activities, a minimal analysis by *status*, *occupation*, *function* or *level of responsibility* is necessary. This could distinguish between the following broad occupational groups[1].

i) Professional, technical and related workers
ii) Administrative, executive and managerial workers
iii) Clerical workers
iv) Sales workers
v) Transport workers
vi) Production and process workers

Alternatively, the following functional classification could be used[2]:

i) Production
ii) Research and development
iii) Education
iv) Management and administration
v) Other

A shorter classification that in some ways cuts across the preceding occupational and functional analyses but which has advantages in the context of educational planning, would be the following[3],

i) University graduates
ii) Technicians
iii) Workers—Skilled
    Other

iv) Other

Such a classification by itself would, however, be of limited use: it would indicate *level* but not *content* of training needed. As pointed out above, ideally cross-classifications between employing sector and function or status should be made.

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[1] These are slightly modified titles of the relevant Major Groups of the International Standard Classification of Occupations.

[2] See "Suggested Analysis of Graduates and Technicians" prepared by Prof. Malassis, already referred to,which uses the same classification as that employed in the questionnaire for the OECD Third International Survey on the Demand for and Supply of Scientific and Technical Personnel. (See *Resources of Scientific and Technical Personnel in the OECD Area*: OECD 1963.)

[3] This is a slightly modified version of the classification of manpower engaged in research and development work recommended in the OECD *Proposed Standard Practice for Surveys of Research and Development*, and is very similar to the classification used in the enquiry on R & D in agriculture carried out by the OECD Directorate for Agriculture.

c) Again, as for the agricultural labour-force, separate data should be collected by quinary *age-groups* and by *sex*.

d) Similarly, data on *educational level* should be obtained, and the earlier remarks on the problems of assessment are again relevant.

e) *Supplementary data* of the following types should be obtained whenever possible:

- *i*) Cross-classifications of the above characteristics
- *ii*) Nature of employment of school- and college-leavers: First job, job after five years, job after ten years.

3. EDUCATIONAL STOCKS AND FLOWS

9. There are a large number of types of statistic which are highly desirable for educational planning in general[1], and the following are some further types of data that are particularly relevant to agriculture:

10. School, college and university *new admissions, numbers on roll and graduations* classified by

- *i*) Fathers' occupation
- *ii*) Urban/rural residence
- *iii*) Type and duration of course

4. EDUCATIONAL RESOURCES

11. Data should be assembled for agricultural training on lines similar to those appropriate for educational resources in general[2] but particular attention should be paid to part-time courses, short (i.e. less than one year) courses, student numbers and place needs.

V. FURTHER RESEARCH

12. Research should be conducted on the following vital problems:

- *a*) The general methodology of projecting manpower stocks and flows, by employing sector, by function and by educational level
- *b*) The productivity of investment in agricultural education and training[3]
- *c*) The comparative advantages of differences in —
  - *i*) school size and/or location
  - *ii*) class size
  - *iii*) course duration and/or time of year[4]

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[1] See OECD "*Handbook of Statistical Needs for Educational Investment Planning*".

[2] See Footnote 1.

[3] On the general problem of the economic value of investment in education, see "*The Residual Factor and Economic Growth*" OECD, 1964, and the references cited in that report. On the particular problem of the relationship between agricultural output and the educational level of the farm labour-force, see Z. Griliches, "Research expenditures, education, and the aggregate agricultural production function" in *American Economic Review*, December 1964, and the relevant other studies he cites in that paper.

[4] For a discussion of some aspects of the problems mentioned in items (c)-(g) above, see "*Selection of the Best Forms of Vocational Training in Agriculture*", AGR/T (64)39 (OECD, 1965).

d) The pedagogic problems of training—
  - *i*) new recruits to agriculture
  - *ii*) under-trained but experienced men
  - *iii*) elderly operators

e) Other pedagogic problems—
  - *i*) the balance between general basic training and agricultural subjects
  - *ii*) the balance between training and information programmes (including advisory services)
  - *iii*) the need for 'continuous re-education' through refresher courses or other means

f) The relationship between training *level* and syllabus *content*,

g) The impact of alternative syllabuses on resource needs in terms of buildings, equipment, textbooks, teaching and auxilliary staff.

SHORT BIBLIOGRAPHY

In addition to the sources cited in the Foreword and in the bibliographies at the end of each country chapter, the following reports should be consulted. These reports themselves contain other relevant references.

Manual of Educational Statistics, UNESCO, Paris (1961).

Economic and Social Aspects of Educational Planning, UNESCO, Paris (1963).

Employment Forecasting, OECD Paris (1963).

Economic Aspects of Higher Education, OECD Paris (1964).

The Residual Factor and Economic Growth, OECD Paris (1964).

The Mediterranean Regional Project—An Experiment in Planning by Six Countries, OECD Paris (1965).

The Mediterranean Regional Project—Country Reports, OECD Paris (1965). (The report on Greece is particularly relevant).

Econometric Models of Education—Some Applications, OECD Paris (1965).

Handbook of Statistical Needs for Educational Investment Planning, OECD Paris (1966).

Organisational Problems in Planning Educational Development, OECD Paris (1966).

APPENDICES

Appendix I

ANALYSIS OF THE STOCK OF AGRICULTURAL GRADUATES AND TECHNICIANS AND METHODOLOGY OF FORECASTING AND PROGRAMMING REQUIREMENTS

by

L. MALASSIS

The following paper was presented to the Third Working Conference of Representatives of University Level Education in Agriculture in OECD Member Countries held at OECD Headquarters, Paris, from 18th to 22nd October, 1965.

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ANALYSIS OF THE STOCK OF AGRICULTURAL GRADUATES AND TECHNICIANS AND METHODOLOGY OF FORECASTING AND PROGRAMMING REQUIREMENTS

by

L. MALASSIS

I. INTRODUCTION: INADEQUACY OF THE BASE DATA

1. Forecasting and programming requirements of graduates in the agricultural sector demands a good prior knowledge of the available numbers of agricultural graduates and technicians and their distribution by branch of activity, type of organisation, function and age. But, on the whole, their numbers are very imperfectly known. Statisticians have not yet come to incorporate regularly in their collected data figures showing percentages of trained agricultural manpower of various standards, numbers of research workers, teachers and advisory staff in agriculture, proportionate numbers of qualified scientists and technicians, etc. Where such data exist, they are scattered and fragmentary.

2. This is all the more to be regretted because recent studies tend to prove that "intellectual investment" is a vital factor in economic growth[1]. It is generally agreed that the expansion of agriculture in Europe depends neither on bringing more land into cultivation, nor on a larger labour force (both tillage acreage and manpower have diminished), but on the simultaneous accumulation of capital equipment and technical knowledge. It is therefore to be hoped that statisticians will endeavour to give us a more accurate picture of the ratios and standards of training of those engaged in agriculture, with details of the stock of graduates and technicians. The lack of statistics makes it difficult, if not impossible, to carry out studies which might greatly assist a fuller understanding of the existing pattern and how it could be improved. Clearly, no realistic development programme can be proposed without a proper knowledge of the existing situation.

3. It is fortunate that OECD makes a regular survey of the resources of scientific and technical personnel. The results of the third international survey on the demand for and supply of scientific and technical personnel were published in 1963[2]. Although this survey does not lend itself to every type of desirable analysis, it is one of the best sources of information. It has the advantage of

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[1] See "*The Residual Factor and Economic Growth*", OECD Paris, 1964.

[2] *Resources of Scientific and Technical Personnel* in the OECD. Area: Paris, 1963.

following a standard classification, which allows international comparisons to be made. Scientific and technical personnel are classified into three main categories[1]:

i) university trained scientists and engineers;
ii) scientists and engineers with other formal training;
iii) technicians.

"Agricultural disciplines" cover agriculture, forestry, certain agricultural industries, agricultural engineering, and veterinary medecine. The agricultural sector comprises agriculture, forestry, hunting and fishing. We shall make frequent use of these terms in the remainder of this report. We shall consider in turn the statistical difficulties of analysing the present stock of graduates and technicians and the methodology of forecasting and programming, with a view to providing some guidance for a policy for the development of agricultural education.

II. STATISTICAL ANALYSIS OF THE STOCK OF AGRICULTURAL GRADUATES AND TECHNICIANS

1. DISTRIBUTION BY BRANCH OF ACTIVITY

4. Agricultural education is not confined to one sector: its graduates are not trained exclusively for agriculture, and graduates employed in agriculture do not all have an agricultural training behind them. It is not, therefore, possible to ascertain what functions are performed by agricultural graduates and technicians from the returns of the numbers employed *inside* the agricultural sector. This demands a *general* census of graduates and technicians, or follow-up enquiries by ex-students' associations, if sufficiently representative.

5. Mr. Vermot-Gauchy's approach, based on the French statistics for 1955[2], is of particular interest in this connection. Mr. Vermot-Gauchy refers to the "Training Group", embracing engineers coming from schools providing a sufficiently homogeneous training for them to be regarded as interchangeable; and the "Sectoral Inter-relationships" revealed by the proportion of engineers of various types of training existing in each economic sector[3]. He goes on to draw up a double entry table, of which an extract is reproduced on the opposite page (Table 1). It clearly shows that all "Engineering Training Groups" play some part in agriculture, but the "Agricultural Training Group" predominates, representing over 70 per cent of the total. Moreover, the "Agricultural Training Group" is represented in all sectors: about 40 per cent of the total number of agricultural graduates work in the agricultural sector proper, 33 per cent in the public services, and 25 per cent in other sectors.

6. The third OECD International Survey on Resources of Scientific and Technical Personnel showed that this was typical of the general situation. In the seven Member countries which sent replies on the distribution of agricultural

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[1] For further particulars of the classification, refer to the questionnaire at the end of the report or the summary classification on page 22 of the report.

[2] *Forecasting Manpower Needs*: OECD Paris, 1960.

[3] *Ibid*, page 60.

TABLE 1. DISTRIBUTION OF ENGINEERS (1955)

ECONOMIC SECTORS (AND GEOGRAPHIC REGIONS)	LINE NO.	ENGINEERING TRAINING GROUPS											LINE NO.
		AGRICULTURAL	MECHANICAL	ELECTRICAL	CHEMICAL	PROSPECTING AND MINING	PUBLIC WORKS BUILDING	TEXTILES	MISC. INDUSTRIES	GENERAL TRAINING	GOVERNMENT TECHNICIANS	TOTALS	
COLUMN NO.		1	2	3	4	5	6	7	8	9	10	11	
I. NOT YET IN EMPLOYMENT[1]													
Engineers on military service	00	740	1,000	1,400	500	240	620	60	10	680		5,250	00
II. IN EMPLOYMENT													
1. Metropolitan France													
Agriculture	4	5,420	780	215	460	20	45	25	5	510		7,480	4
Fuel and Power	5	90	1,295	3,690	645	1,230	145	10		1,735		8,840	5
Transport	6	65	1,700	1,245	50	115	275		10	1,225		4,685	6
Public Works and Building	7	65	1,720	2,135	175	160	2,485	15		1,255		8,010	7
Metallurgy	10	380	13,110	10,815	1,270	1,020	385	125	60	5,320		32,485	10
Chemicals	11	700	1,085	815	5,670	250	45	95		1,345		10,005	11
Textiles and Leather	12	65	470	240	1,490	20	20	2,250		345		4,900	12
Miscellaneous Industries	13	180	425	1,415	210	35	50	75	655	420		3,465	13
Private services	14	1,550	495	1,125	585	160	600	55	5	2,055		6,640	14
Public services	15	4,185	2,500	2,285	1,875	440	2,450	15	35	735	5,500	20,020	15
Total	18	12,700	23,580	23,980	12,430	3,450	6,500	2,665	770	14,955	5,500	106,530	18
2. Outside Metropolitan France	25	3,610	2,330	1,800	1,220	980	1,760	285	220	1,515		13,720	25
3. Total in employment	26	16,310	25,910	25,780	13,650	4,430	8,260	2,950	990	16,470	5,500	120,270	26
III. RETIRED	28	1,650	2,590	2,320	1,350	430	620	350	60	1,650		11,020	28
IV. GRAND TOTAL	30	18,700	29,500	29,500	15,500	5,100	9,500	3,360	1,060	18,800	5,500	136,590	30

[1] By taking into account the time lag between engineers in universities and those in employment, or retired, the addition of a few lines at the top of the chart for engineers in training (engineering students and apprentices) would have enlarged the basis of the forecast and made it easier to work out a supply policy.

Source: "*Forecasting Manpower Needs*", OECD, 1960.

graduates by economic sector, 58 per cent of the total were employed in services, 13 per cent in industry and only 29 per cent in agriculture. The proportions vary with the country, however, as can be seen from Table 2 where the countries are classified in decreasing order of the proportion of agricultural graduates employed in the agricultural sector.

TABLE 2. DISTRIBUTION OF AGRICULTURAL GRADUATES BY ECONOMIC SECTOR, 1959

COUNTRY	PERCENTAGE OF TOTAL			TOTAL NUMBER ('000)
	AGRICULTURE	INDUSTRY	SERVICES	
Yugoslavia	42	9	49	9
Sweden	42	15	43	3
France	41	10	49	18
Italy	28	13	60	40
Austria	22	16	62	7
Greece	20	1	79	3
Belgium	7	23	70	3

Source: Third Survey, Table 67, page 118.

The table indicates that in some countries the majority of agricultural graduates work in the services sector. This statistical result can be largely explained by the fact that research, training, advisory services, distribution and inspection of produce, etc., are counted as services. It represents an important characteristic of the stock of agricultural graduates and technicians: the number of such personnel in '*external*' employment (in the appropriate services) *is greater* than the number in '*internal*' employment on farms etc. The number working on farms obviously largely depends on the structure, and especially the size, of the latter.

2. RATIO OF SCIENTIFIC AND TECHNICAL PERSONNEL TO TOTAL LABOUR FORCE

7. The relationship between the number of scientists and technicians and the total labour force is sometimes called the "ratio of scientific and technical personnel". The ratio varies according to the geographical area, economic sector and period of time considered. In the OECD area as a whole, the stock of qualified scientists and engineers [(*i*)+(*ii*): paragraph 3] represents approximately 12 per thousand of all employed persons; the proportion is about 16 per thousand in North America, and under 10 per thousand in the European countries[1]. The proportion of university trained scientists and engineers is extremely low in the Mediterranean area: 4 per thousand in Greece and 1 per thousand in Turkey. In the Scandinavian countries taken together, on the other hand, it is relatively high, being above the average for Europe and not far short of the average for North America (Table 3).

8. The proportion of scientific and technical personnel [(*i*)+(*ii*)+(*iii*) see paragraph 3] to numbers of employed appears more significant: in some countries, more resources may have gone into university training than into the train-

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[1] Third Survey, page 106.

TABLE 3. PER CAPITA GDP AND RATIO OF SCIENTIFIC AND TECHNICAL PERSONNEL TO TOTAL LABOUR FORCE

COUNTRY	PER CAPITA GDP IN US DOLLARS	NUMBER PER 1000 OF THE CIVILIAN LABOUR FORCE		
		UNIVERSITY TRAINED SCIENTISTS AND ENGINEERS	SCIENTISTS AND ENGINEERS	SCIENTIFIC AND TECHNICAL PERSONNEL
	1	2	3	4
United States	2,691	..	1.7	2.7
Canada	1,809	1.3	1.3	..
Sweden	1,703	0.7	1.4	2.6
Denmark	1,390	0.8	1.2	1.7
Germany	1,345	(0.6)	(1.3)	(1.9)
France	1,310	0.8	0.8	1.9
United Kingdom	1,292	..	1.0	..
Norway	1,280	0.9	1.9	2.0
BLEU	1,218	0.5	1.0	2.2
Netherlands	1,007	0.4	1.0	..
Austria	877	0.6	1.4	..
Italy	683	0.9	1.7	..
Greece	394	0.4	0.4	..
Turkey	193	0.1	0.1	..

.. Not available
Sources: Col 1: *Agriculture and Economic Growth*, OECD, Table 1; Col 2, 3, 4: *Third OECD Survey*, page 112, Table 61.

ing of technicians (this seems to be the case in the agricultural sector in Italy). The available statistics do not lend themselves to further analysis. Only seven European countries and the United States have made estimates (which seem, in certain cases, somewhat unreliable) of the stock of technicians. The total ratio of scientific and technical personnel would seem to be about 30 per thousand in North America and 20 per thousand in Europe[1]. It is 26 per thousand in Sweden.

9. Ratios of scientific and technical personnel vary with the economic sector: the ratio is relatively low in agriculture. In agricultural regions where small farms predominate (mainly family farms), scientists and technicians are made available to farmers through the public services or agricultural organisations and are usually classified under the heading of "services". It is not surprising that agriculture shows a very low "ratio of scientific and technical personnel on farms", usually under 2.5 per thousand, while the corresponding figure for industry is 10 to 15 per thousand[2]. This 'internal' ratio must, however, be considered in conjunction with the 'external' ratio (especially in advisory services) to calculate the total number of scientific and technical personnel available to agriculture. Such calculations cannot be made from the basic statistics and the tables extracted from the OECD survey.

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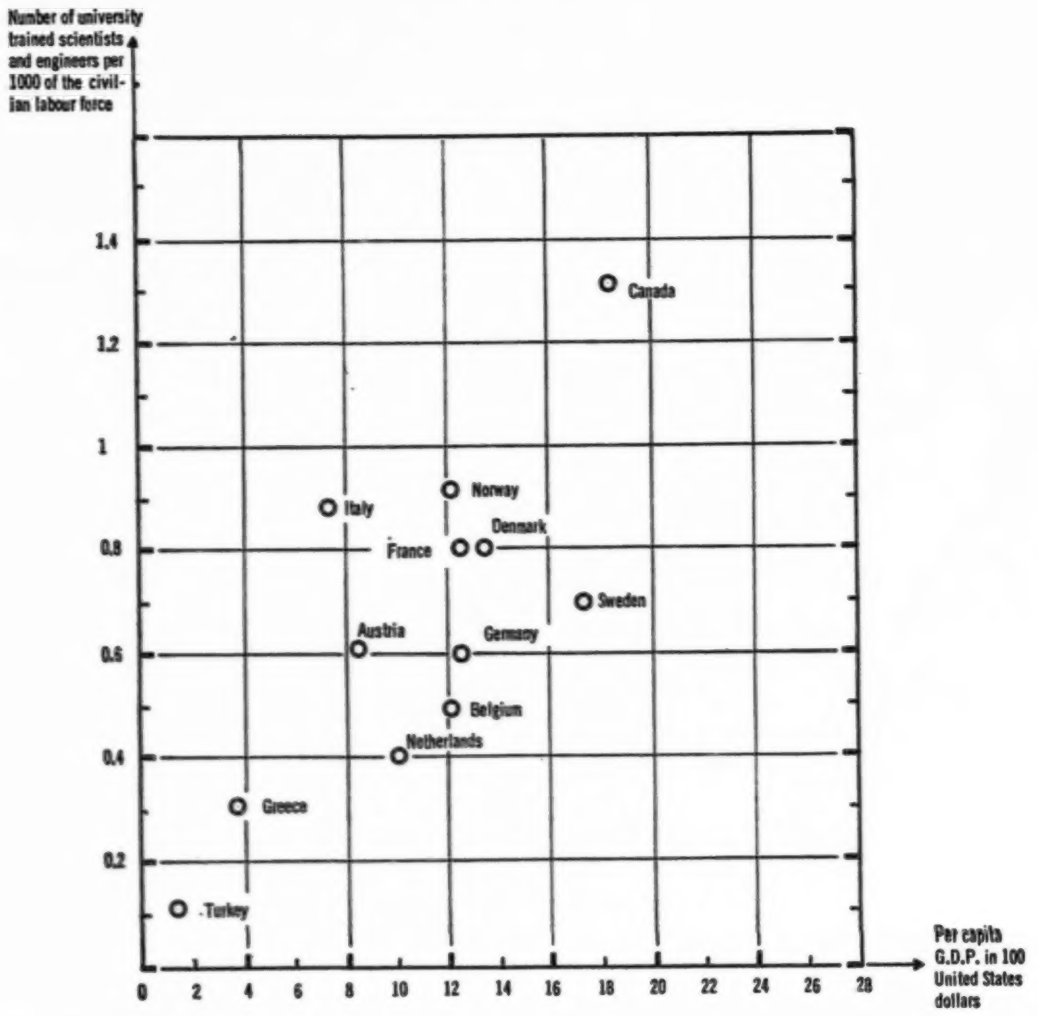
[1] Third Survey, page 110.
[2] *Ibid.* page 111, graph 8.

PER CAPITA GDP IN RELATION TO THE NUMBER OF UNIVERITY TRAINED SCIENTISTS AND ENGINEERS



Source: Table 3.

N.B. The trend is less clear for other types of qualified manpower. The statistical estimates are probably most reliable for those with university training (estimates of the number of technicians, for instance, are far less sound).

10. It may be assumed that there is some correlation between the ratio of scientific and technical personnel and labour productivity and, more generally, between the ratio of scientific and technical personnel and the level of economic and social development. (The graph seems to confirm this.) Changes in the ratio clearly depend on changes in the working population and in the numbers of scientists and technicians; if the latter rise faster than the former, the ratio will increase; the statistics in certain countries indicate such a trend. In Sweden, for instance, the proportion of scientists, engineers and technicians, which was about 18 per thousand in 1950, should rise to 41 per thousand by 1970. It is characteristic of the development of the 'technological society' that the number of scientists and technicians tends to grow in relation to the total labour force as well as in absolute figures.

11. The agricultural sector displays the peculiarity of having a dwindling population but, contrary to what is frequently asserted, the decline in numbers coincides with an improvement in quality. The following trend may be postulated: in an expanding economy, the agricultural population declines in relative size, and usually in absolute figures, while the standard of training of those engaged in agriculture, and the ratio of scientific and technical personnel are rising. The reduction in the numbers actively engaged in agriculture may result in the ratio growing faster, even if the numbers of scientists and technicians rise more slowly in that sector than in others. It is a matter for regret that the available statistics do not lend themselves to certain comparisons and caculations which might prove fruitful.

3. RATIO OF GRADUATES TO TECHNICIANS

12. It is a vital condition of efficiency that the distribution of scientists and technicians by standard of qualification and by branch of activity should correspond to the pattern of requirements for economic and social development. Otherwise, the graduate may have to perform the duties of a technician, and the technician grapple as best he can with tasks that are beyond his powers. It should, however, be made clear that such an 'efficient structure' cannot be achieved by merely adjusting the output of the educational system, and that further training must play an important part. The individual must have the conviction that, whatever his background, however far he has come, and whatever the age at which he reaches his full mental powers, he can accede, by further training, to a position worthy of his real abilities. The statistics should therefore distinguish between *qualified* scientists, engineers and technicians, and persons *without formal qualifications* holding scientist, engineer or technician posts.

13. The ratio of scientists and engineers to technicians provides a first indication of the structure of the stock of specialised manpower. Figures of from 1: 1 to 1: 4 have been advanced: the ratio clearly differs according to region and economic sector. The OECD survey elicited the fact that the United States possessed about 1,096,000 science graduates and engineers[1] and about 700,000 technicians[2], giving a ratio of 1.5 scientists and engineers to one technician. For the seven countries which have supplied estimates of the number of technicians[3], the aggregate total is also about 700,000[4], while the total number of scientists and engineers is about 700,000 to 900,000[5], giving a ratio of over 1: 1. These statistical relationships are, however, of limited significance, because of their very general character: ratios for each branch of activity would be more meaningful and useful for forecasting and programming. Such a ratio is not available for the agricultural sector. It would, in any case, be of little significance as, in that sector, training for 'technicians' has only been organised fairly recently.

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[1] Third survey: Table 62, page 113.
[2] *Ibid*, page 109.
[3] Belgium, Denmark, Germany, Italy, Norway, Sweden, France.
[4] Third survey, page 109.
[5] *Ibid*, page 113, plus an estimate for Germany.

4. DISTRIBUTION BY FUNCTION

14. The third OECD survey proposed a general classification of engineers' and technicians' functions under Production; Research and Development; Teaching; Management and Administration; and Other Functions[1], but this survey "only resulted in scattered data[2]". In the United States, for example, 7 per cent of all university-trained scientists and engineers are teachers[3]; we have no information about the work technicians are employed on.

15. As far as agriculture is concerned, the report on the first Working Conference of Representatives of Agricultural Faculties of Universities and Institutes of a Similar Standing contains a highly interesting statical annex[4]. It includes, in particular, a table on *employment of graduates*, showing that a large percentage obtain their first employment in an agricultural administrative post, generally in research, advisory work or teaching[5]. The chief need is to ascertain the trend of employment in relation to economic and social development: there seem to be signs of a relative decline in the percentage employed in the public sector and of a rise in the percentage employed in the private sector, as the structure of agricultural production (with qualified personnel on farms) changes, the farming profession becomes organised, and as agricultural and food industries develop; and pursuant upon these developments, the State gradually ceases to be the chief employer of agricultural graduates.

16. The statistical information available about the jobs filled by agricultural graduates is quite inadequate: there is frequent confusion between "type of employer" and "function". We suggest, at the end of this paper a form of analysis which would avoid such confusion. It provides for classification by economic sector, type of organisation (independent, collective, public or semi-public), and function (according to the general OECD classification). This outline table is put forward tentatively, and calls for further discussion and clarification[6].

5. AGE PYRAMID OF GRADUATES AND TECHNICIANS

17. Another essential element in educational forecasting and programming is the 'age pyramid', which directly influences the 'rate of turnover' of the stock of graduates and technicians. In view of the tendency for the self-educated to be replaced by personnel with formal training, such a pyramid should be drawn up for non-graduates employed as scientists, engineers and technicians, as well as for graduates. France can be taken as an example to illustrate this point. A 1962 study[7] showed that 73 per cent of the "specialists" (qualified scientists or engineers and technicians or persons in equivalent posts) employed

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[1] Third survey, page 278.

[2] *Ibid*, page 121.

[3] *Ibid*, page 122.

[4] *Higher Education in Agriculture:* OEEC. Documentation on Food and Agriculture No. 30, 1960.

[5] Table 12, page 127.

[6] A study carried out in the USA in 1963-64 used a much more detailed analysis: see "*A Survey of Placement: Agricultural College Baccalaureate Graduates, Spring 1963*" by Research Committee, American Association of State Universities and Land Grant Colleges, 1964.

[7] *Étude sur le marché du travail des cadres de l'agriculture, des industries agricoles et alimentaires et du secteur para-agricole 1957, 1962 et 1967;* APECITA, 11 rue de Clichy, Paris 9.

TABLE 4. AVERAGE ANNUAL INCREASE IN THE STOCK OF AGRICULTURAL GRADUATES

Percentage.

COUNTRY	1950-55	1955-59	1959-63	1963-70
Belgium	3.1	−4.2	2.6	—
Canada	—	—	2.9	—
Denmark	1.6	1.6	1.4	2.6
France	0.2	0.1	0.9	2.1
Greece	—	4.0	—	—
Italy	12.3	—	—	—
Netherlands	—	2.2	2.0	1.8
Norway	1.0	2.7	1.7	1.8
Sweden	1.8	0	0	0.9
Switzerland	2.5	—	—	—
Turkey	—	14.7	—	—
Yugoslavia	—	8.9	14.8	—

Source: Third survey, Table 71, page 126.

Remarks: Data from 12 European countries accounting for 77 per cent of the total European stock of agricultural scientists in 1959, and 80 per cent of the output of such personnel in European Member countries, show an increase of 2.5 per cent annually in the period 1955 to 1959 (page 123).

TABLE 5. CHANGES IN THE RELATIVE IMPORTANCE OF UNIVERSITY TRAINED AGRICULTURAL SCIENTISTS

Percentage.

COUNTRY	PROPORTION OF AGRICULTURAL SCIENTISTS IN THE TOTAL NUMBER OF UNIVERSITY-TRAINED SCIENTISTS AND ENGINEERS				
	1950	1955	1959	1963	1970
Belgium	18	18	15	14	—
Canada	—	—	18	17	—
Denmark	35	34	33	32	30
France	13	13	12	11	8
Greece	—	20	22	—	—
Italy	8	11	—	—	—
Netherlands	—	20	17	16	14
Norway	26	24	23	20	17
Sweden	18	17	15	10	8
Switzerland	13	11	13	10	9
Turkey	—	14	17	—	—
Yugoslavia	—	23	23	27	—

Source: Third survey, Table 73, page 130.

on farms, 40 to 60 per cent of those employed by organisations dealing with agricultural economics and finance (co-operative, mutual insurance societies, credit institutions), and 20 to 40 per cent of those employed in industries related to agriculture were self-taught; the study also revealed the ageing of the stock of trained specialists in certain branches.

6. NEED FOR A THOROUGH INTERNATIONAL SURVEY OF THE STOCK OF AGRICULTURAL GRADUATES AND TECHNICIANS

18. To adapt the volume and standard of agricultural training more closely to economic and social development, we need more knowledge of the subse-

TABLE 6. ENROLMENT IN SCIENTIFIC DISCIPLINES
IN RELATION TO TOTAL STUDENT NUMBERS 1959

Percentage.

COUNTRY	NATURAL SCIENCES	ENGINEERING	AGRICULTURE	ALL SCIENTIFIC DISCIPLINES
Turkey	19.5	19.5	9	48
Norway	21	19	4	44
Switzerland	20	17	2	39
United Kingdom	23	17	3	43
Denmark	7.5	21.5	8	37
Netherlands	14	19	4	37
Austria	8.5	24	3.5	36
Germany	15	18	2	35
Yugoslavia	5	18.5	7.5	31
Sweden	15	15	2	32
Belgium	13	13	3	29
Ireland	14.5	8.5	9	32
Canada	8	15	3	26
Spain	16	7	3	26
Italy	11	12	2	25
Greece	9	8	4	21

Source: Third survey, table 16, page 53.

N.B. The proportion of agricultural students enrolled is declining in relation to total student numbers: it fell from 4 per cent in 1950 to 3 per cent in 1959, and is likely to be down to 2 per cent in 1970. Taking science students alone, the proportion studying agriculture is steadily falling: it was 14 per cent in 1950 and 9 per cent in 1959, and is estimated at 6 per cent in 1970.

quent history of the 'end-product' of agricultural training and better methodological forecasting and programming instruments.

19. We earnestly hope that the OECD will take the initiative in promoting a thorough periodic survey[1] of the stock of agricultural graduates and technicians, indicating, in particular, their distribution by branch of activity, type of organisation, function and age, and allowing the ratio of scientific and technical personnel employed in farming and in the agricultural sector as a whole to be calculated, as well as the ratio of scientists and engineers to technicians. In the absence of such a prior survey, the policy for the development of agricultural education will lack any scientific basis, and may thus be ruled by subjective appraisals and short-term trends.

III. FORECASTING AND PROGRAMMING

1. FORECASTS BY OECD MEMBER COUNTRIES

20. The Third Survey includes some forecasts of changes in the numbers of scientists, engineers and technicians, but the premises on which they are based

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[1] To be conducted in conjunction with the periodic survey on the demand for and supply of scientific and technical personnel, but on more exhaustive lines more appropriate for the analysis of qualified technical manpower in agriculture.

are not explicitly stated. Some trends do, however, emerge from the recent assessments and the forecasts made by certain countries[1]. The number of agricultural graduates is tending to increase in absolute terms (over the period 1950-59, the rate of growth was about 2.5 per cent per year in Europe (Table 4), but it is declining in relation to the total stock of scientists, engineers and technicians (Table 5). As a result, the number of agricultural students represents a falling proportion of the total (Table 6). However, this trend, while it is compatible with the relative decline of agriculture in an expanding economy, may have, as an underlying cause, the failure of agricultural education to adjust its standards to the process of growth, with the consequence that graduates are substituted in some jobs by others from competing disciplines; or it may even be due to the fact that the agricultural educational system does not make a determined effort to conquer new openings.

The Member countries' estimates of new entrants to higher (agricultural) education are given in Table 7:

TABLE 7. NEW ENTRANTS TO HIGHER AGRICULTURAL EDUCATION: MEMBER COUNTRIES' ESTIMATES

COUNTRY	1950	1959	1970
Germany	1,192	857	900
Austria	—	209	350
Belgium	222	157	308
Denmark	203	303	500
France	600	700	1,400
Greece	—	176	—
Italy	903	750	790
Norway	86	112	165
Netherlands	252	319	410
United Kingdom	—	884[1]	—
Sweden[2]	46	44	100
Turkey	—	476	—

1. 1958.
2. Figures supplied by Dr. Petrini.
Source: Third Survey, page 206, Table 3.

The table shows a rising absolute number of new entrants to higher agricultural education.

21. The ultimate object of forecasting requirements is to estimate the probable shortages or surpluses, in the light of the present output from the educational system, and then work out a policy for securing better adaptation of supply to requirements. It is clear from the OECD survey that most Member countries are not able to give a definite reply on this subject[2]. The concept of a 'shortage' or 'surplus' of qualified personnel may be understood in various ways[2]. We think it has two main interpretations:

i) shortage or surplus in relation to targets established by appropriate methods;

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[1] Third Survey, pages 122 to 131.

[2] *Ibid*, page 177.

ii) short or surplus supply in relation to the demand for scientists or engineers and technicians (imbalance in the labour market for this category of manpower).

The shortage or surplus may be general, or localised in certain branches or areas of activity. The relatively rapid growth in the OECD countries over the last few years has set up a pressure of demand on the area's resources, especially the stock of scientists and technicians. Of the 14 OECD countries which have drawn up estimates of the "shortage situation", eight indicate a "shortage" or "general shortage" of scientists and engineers in 1959. The survey gave no estimates for agricultural graduates.

2. GENERAL LINES OF FORECASTING REQUIREMENTS OF AGRICULTURAL SCIENTISTS OR ENGINEERS AND TECHNICIANS

22. Forecasting the numbers of scientists or engineers and technicians required entails calculating, for each standard of qualification and each branch of activity:

i) the number of jobs to be created,
ii) the extent to which qualified personnel are replacing persons without formal qualifications in graduate or technician posts,
iii) the number of jobs eliminated,
iv) the rate of turnover for the remainder.

The estimate may be medium-term (for five years) or short-term (for one budget year) or part of a long-term forecast.

23. Some interesting recent studies have dealt with the economics of higher education[1]. The problem of forecasting methods has been raised. The classification of such methods is a matter of some difficulty, but they seem to fall into two main categories:

i) estimates of desirable targets
ii) analyse of demand (market research).

Estimates of 'desirable targets' are based on estimates of the trend of employment by economic sector and of the required standards of qualification (or optimum ratio of scientific and technical personnel), given certain assumptions of economic growth. The optimum ratio is itself calculated from the trend of labour productivity, models built to show the ratio for various types of organisation, international comparisons, etc. This is the method generally preferred by scientists and technicians. The *desirable* targets can, however, only become *probable* if there is a genuine corresponding demand (in a market economy) or if the Government is able to introduce measures allowing the desirable targets to be attained (in a programmed economy).

24. The purpose of market research is to determine probable demand. Various approaches are possible, e.g.: projection of past trends into the future (usually best left alone); summation of the employment possibilities as ascertained from employers[2] (clearly distinguishing the real from the potential market);

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[1] *Economics of Higher Education*: United States Department of Health, Education and Welfare, Office of Education, Washington, 1962; *Economic Aspects of Higher Education*, (OECD, 1964).

[2] APECITA Survey (France) op. cit.

estimation by an ad hoc committee[1]; an analysis of demand (establishment of a demand function incorporating the different variables which affect the market for scientists and technicians).

3. PROGRAMMING METHODS

25. The term 'programme' should be understood to cover the choice of targets, means and time limits. The targets should be attainable within the specified time with the resources allotted. As a result, the different related items of the programme are determined by successive corrections, or by a set of simultaneous equations. To state the problem of education in terms of allocation of resources is tantamount to stating it in terms of economic return or relative productivity. What proportion of the available resources should we allot to capital, and what to intellectual investment? This question points to the importance of recent studies on the productivity of education and its role in economic growth[2].

26. Education in Europe is largely financed from public funds. The problem of the development of education can therefore be stated in terms of budget appropriations and Government finance. There are three main questions to be considered:

i) What proportion of public funds should be allotted to education?
ii) How should these funds be divided among the various types of education (in the broad sense): research, education, advisory work, further training, other types?
iii) Should the agreed targets be achieved by increased taxation, raising loans, ear-marking budget receipts (from a special education tax) or increasing the proportion of finance from private sources?

27. The machinery for the allocation of budget funds depends on many factors but, in this field as in others, the aim in view is to light up the scene for those who have to make the decisions. For this purpose, estimates of desirable targets or analyses of probable demand may be used. Where educational programming is linked with a general programme of economic and social development, the approach usually advocated[3] and most widely used (see the French Plan) is that of calculating employment by economic sectors (allowing for relative growth of output and productivity) and laying down standards of qualification.

4. DEVELOPMENT OF A GROWTH ASSUMPTION FOR AGRICULTURAL TRAINING AT PROFESSIONAL AND TECHNICAL LEVELS

28. When, as a first step, either targets or resources have been selected, the other of these can be calculated, if standards of reference are available, and successive corrections can be made. Such calculations are feasible for secondary agricultural education[3], but studies of higher education are less simple.

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[1] *The Demand for Agricultural Graduates:* Report of an Interdepartmental Committee: Her Majesty's Stationery Office, London, 1964.

[2] *The Residual Factor and Economic Growth:* (OECD, 1964).

[3] OECD Pilot studies on Sweden and France.

IV. CONCLUSION AND RECOMMENDATIONS

29. The present paper includes no forecasts or programme for the development of higher agricultural education. There are at present two obstacles to the compilation of such a programme:

i) manifestly inadequate statistics,
ii) insufficiently detailed methodology.

If we really to not possess the data required to lay the scientific basis of a policy for the development of higher agricultural education, the logical conclusion is that such a policy largely depends on subjective judgements, and may be greatly affected by short-term trends and considerations which have no connection with economic and social development. Although it is probably not always possible to define the requisites for a rational decision, the investigator should attempt to do so. His purpose is to 'light up the picture' for the decision-makers at every level and in every field of activity.

30. This leads us to make two recommendations:

i) We very much hope that the OECD will promote a periodic survey of the stock of agricultural graduates and technicians, to be carried out on a standard basis which allows of international comparisons, especially as regards distribution by branch of activity and type of organisation, and which permits calculation of the ratios of such personnel employed 'internally', 'externally' and in agriculture as a whole, as well as the ratios of graduates to technicians.

ii) We also hope that the methodology of forecasting and programming for higher agricultural education will be improved to enable the volume and standard of such education to be better adjusted to economic and social development. In the light of the prospects for European agriculture, which is now undergoing a complete transformation, it should be possible to construct 'models of ratios of scientific and technical personnel' as a basis for our conception of desirable future development, and to introduce a control policy, or some methods of conquering new outlets in order to turn the desirable into the probable.

ANNEX

SUGGESTED ANALYSIS OF GRADUATES AND TECHNICIANS BY SECTOR, TYPE OF ORGANISATION AND FUNCTION[1]

EMPLOYER / EMPLOYMENT FUNCTION		AGRICULTURE 1				AGRICULTURE AND FOOD INDUSTRIES 2				AGRICULTURAL SERVICES 3				OTHERS 4			
		FARMS	AGRICULTURAL ORGANISATIONS	PUBLIC SECTOR	NATIONALISED OR SEMI-PUBLIC UNDERTAKINGS	ENTERPRISES	TRADE ORGANISATIONS	PUBLIC SECTOR	NATIONALISED OR SEMI-PUBLIC UNDERTAKINGS	ENTERPRISES	TRADE ORGANISATIONS	PUBLIC SECTOR	SEMI-PUBLIC UNDERTAKINGS	INDUSTRY	SERVICES	TECHNICAL CO-OPERATION	TOTAL
0		11	12	13	14	21	22	23	24	31	32	33	34	41	42	5	6
Production	*a*																
Research and development	*b*																
Education	*c*																
Management and administration	*d*																
Others	*e*																
Total																	

I. FUNCTION:
a Production duties and operations
b Fundamental and applied research—development and experiment—advisory work (excluding management and administration of these services)
c Education and further training
d Management and administration
e Other functions: technical and commercial, miscellaneous, etc.

II. ECONOMIC SECTOR AND TYPE OF ORGANISATION
- 1 Crop-farming, horticulture, stock-farming, forestry
  - 11 Farms and other holdings
  - 12 Co-operative farming groups
  - 13 Government-owned land, forests, stud farms, etc.
  - 14 Land improvement companies, etc.
- 2 Industries producing for agriculture or processing agricultural products (makers of fertilizers, chemical products, machinery, animal feedingstuffs, and food industries)
  - 21 Private enterprises
  - 22 Agricultural co-operatives (except supply co-operatives)
  - 23 Public undertakings
  - 24 Nationalised or semi-public undertakings
- 3 Agricultural services
  - 31 Private planning offices, insurance companies, credit institutions, transport undertakings, etc.
  - 32 Advisory services, miscellaneous agricultural associations, friendly societies, loan societies
  - 33 Administration of agriculture: Government research institutes, educational and advisory services, etc.
  - 34 Planning bodies
- 4 Other industries and services.

[1] See paragraph 16 of the text.

Appendix II

SOME PROBLEMS IN MANPOWER PROJECTIONS BASED ON EMPLOYERS' ESTIMATES OF THEIR DEMAND

by

W. N. T. Roberts

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SOME PROBLEMS IN MANPOWER PROJECTIONS BASED ON EMPLOYERS' ESTIMATES OF THEIR DEMAND

by

W. N. T. Roberts

1. In the French study, it was pointed out that one possible method for attempting to forecast the likely future need for trained personnel is to enquire about the future demand of existing employers of such personnel (including the need for replacement for those of the employers who will themselves die or retire during the forecast period). The following paragraphs describe and discuss some of the problems likely to be met in this type of enquiry, with illustrations from the APECITA market survey (French chapter, Annex I). APECITA would be the first to recognise the limitations of their study, and the present appendix attempts to draw useful lessons from their experience rather than merely to criticise their work.

INCOMPLETE RESPONSE

2. This particular survey was an attempt to conduct a complete census of the relevant field, but in practice because of varying degrees of incomplete response, the question frequently arose of whether the replies received were sufficiently typical to justify grossing-up to obtain an estimate for the whole of the sub-field concerned. The results were made more dubious, in that few or no formal tests of bias or of 'typicality' were possible, because the information was generally collected through the appropriate national organisation (e.g. a national federation of specialised cooperative societies). It was of course essential to enlist the active support of such bodies, but the insistence of some of them on handling the whole process of despatch, chasing and checking of questionnaires and tabulation of replies meant uncertain control over the quality of the results. Further, it was usually the professional organisations themselves who decided whether the replies obtained from an incomplete response were or were not 'representative' of their whole membership.

3. This raises three questions immediately, namely (*a*) precisely what criterion can be used to assess 'typicality'—which is the same thing as saying precisely how can the absence of bias be established? (*b*) how complete is the membership of the organisation concerned—indeed is such an organisation able to know if, and to what extent, its membership is complete, and even if it does know, will not the body be reluctant to admit to less than full coverage? and (*c*) might not some enterprises be members simultaneously of two or more trade organisations, to both or all of which such enterprises may be strongly tempted to report their *total* needs of trained manpower? The possibility of

double- or multiple-counting raised by (*c*) is less likely when there are numerous highly specialised professional organisations, provided that there is not more than one in each part of the field (e.g. in feed grains, flour milling, starch manufacture, baking, etc.). There may be no answer to (*b*), and question (*a*) merely underlines in another form the necessity for ensuring close control of the collection and processing of data when these functions are delegated to other organisations than the one running the survey. The question of bias will be considered further later.

4. Before proceeding it should be explained that the APECITA questionnaire (see specimen) asked essentially for the distribution of the number of professional and skilled staff by—

i) function (or occupation)	1957, 1962 and 1967
ii) formal training	
and *iii*) age	1962 only

The layout of the questionnaire was such that, in addition, a cross-classification of function by formal training, and (for 1962 only) of function by age, could be derived if the replies were sufficiently detailed.

GROSSING-UP

5. Except for two important parts of the whole field surveyed, no statistics on personnel were available apart from those yielded by the replies to the questionnaire. Consequently except for those two cases, there was no basis for deriving an estimate from incomplete response apart from the response rate itself, and this is what was done in practice whenever the professional bodies judged that the responses were sufficiently representative of their total membership. Since the questionnaires were sent to *enterprises* asking them about their "cadre" *staff*, the grossing-up of incomplete results by the reciprocal of the response rate is equivalent to postulating that the average number of "cadre" staff per enterprise is the same among respondents and refusals, and this in turn implies that either there is no difference between enterprises of different size in the number of their cadre-staff, or that the size distribution of all enterprises is fairly accurately reflected by the size distribution of responding enterprises. This is consistent with the hypothesis that responses are representative of refusals, but it is not clear how fully this hypothesis was investigated. Further even if respondents do reflect certain known characteristics of the sub-population from which they come, it does not necessarily follow that they are typical of that sub-population with regard to the particular characteristics being investigated (viz. number of "cadre" staff and expected growth in this number).

6. The two fields for which supplementary information was available were (*a*) the food and feed processing industry (for which the total value of output was known, and (*b*) farm enterprises (for which the total number of "cadre" staff was known from registrations under a compulsory social insurance scheme). In the former case, for which the response rate was 32 per cent, the partial results were grossed-up by the reciprocal of the proportion of the known value of *total* output covered by the known output of *responding enterprises*. This is equivalent to postulating that the average number of "cadre" staff per unit of output is the same for respondents as for refusals, and that on average, the number of such staff is proportional to the volume of output. In the case of farm enterprises, for which the response rate was 35 per cent, the partial results were grossed-up by the reciprocal of the proportion of known *total* 1962 cadre co-

vered by the *reported* 1962 cadre. As in the other two methods of grossing-up, this is equivalent to postulating that the distribution by functions, formation and age is the same for respondents and refusals; but unlike the other two methods, it does not assume a constancy, as between responses and refusals, in the average number of cadre per enterprise or in the average number of cadre per unit of output. It is clearly preferable to link forecast changes in cadre staff directly to known cadre totals rather than to estimate the absolute changes in cadre totals (and in the components of these totals) by means of roundabout relationships based partly, if not wholly, on uncertain (though maybe plausible) assumptions. If, however, data are available, a forecast could be based on cadre/output ratios in 1957 and 1962 and on (*a*) the trend in these ratios and on (*b*) the trend in output.

BIAS

7. These remarks lead naturally to a consideration of the likelihood of bias in *a*) the pattern of response and *b*) the replies given by respondents. Since the whole survey relies upon the voluntary cooperation of those to whom questionnaires are sent, one must consider the likely reactions of these enterprises as regards whether or not to reply at all, and if they decide to reply, what kind of reply to give.

8. In general, one would expect the larger and better-organised enterprises (and these two groups do not necessarily comprise the same units) to respond to a postal questionnaire. The results of the APECITA survey provide little evidence either way on this, and what evidence they do provide does not all support this expectation. In the case of farm enterprises, it seems that the average number of cadre per responding enterprise was only about one-half of the average number per 'refusing' enterprise, so that it seems that it was generally the *smaller* farms (employing cadre staff) that replied. On the other hand, in the case of the food and feed processing industry, the average level of output per response was about one-and-a-half times the average output per refusal so that in this case it was the *larger* firms who replied. Only a closer analysis of the size distribution of responses and refusals in terms of some known common characteristic can throw any further light on this, and even then, as has been mentioned already, there is unfortunately no necessary connection between similarities in those characteristics for which data may be available and the characteristics being investigated. Although it seems reasonable to expect the *absolute number* of cadre per enterprise to be roughly proportional to size of business as indicated by e.g. total labour force or volume of sales, it does not by any means follow that the *rate of increase* of that number is larger for bigger than for smaller enterprises—indeed the very opposite may be the case—and it is the rate of change that is of particular importance in a survey of the future demand for trained manpower. One cannot say *a priori* that refusals to cooperate are more likely to occur among the more rapidly expanding enterprises, for the more sensitive among those that are stagnant or contracting may wish to remain in silent anonymity; but it should be noted that some of the lowest response rates were experienced in a segment of the field where one might expect future growth to be particularly marked, viz. cooperatives for farm inputs and for processing and marketing farm outputs.

9. As regards bias in the responses of those enterprises who do cooperate in the survey, one might well expect a firm to exaggerate its estimate of its own need for trained labour in five years' time for two reasons: first through a

natural reluctance to admit that *its* business will not expand, and secondly because even when it is practically certain that a general sector of economic activity will expand, each and every individual enterprise will naturally hope to retain and even increase its share of that activity when in fact there will very probably be a redistribution of market shares at the expense of one or more enterprises. Moreover, once a certain degree of employment of cadre staff has been attained, increased economic activity generally means increased labour-productivity so that the real demand for further trained manpower is likely to expand less rapidly than total economic activity.

10. On the other hand, in the case of an economic sector such as agriculture which, taken together with its supplying industries (e.g. feedingstuffs, fertilisers, agricultural chemicals) and its 'customer' industries (e.g. food processing and marketing), is known to have far too low a present level of training among its labour force, one may well take the view that 'under-trained' personnel in responding enterprises are more likely to under-state than to over-state their enterprises future needs for trained staff. The likelihood of under estimation is all the greater when one considers also the probability of new enterprises being formed in the future, better adapted to modern conditions and unencumbered by possibly traditionalist though doubtless generally competent and very experienced "autodidact" management.

11. In the APECITA study, the comment is made that respondents in at least one segment of the field surveyed did seem to under-estimate the effect of rationalisation on their future manpower needs, thus in at least one csae, there was some exaggeration. On the other hand, a few segments showed no change in their labour needs, and APECITA are of the opinion that the trends suggested for 1962-1967 by the results of the survey correspond very broadly with that organisation's own observation of the labour market for 'cadre' staff since 1962.

12. There are circumstances in which biases in replies to enquiries may be tolerable and indeed useful. If, for example, one wants a minimum estimate of training needs, and one has good reason to believe that some survey results are biased downwards, it is still well worth knowing that the true figures are 'at least as large as' the survey estimate. (Even in rigorously designed sample enquiries, in certain conditions a biased method of estimation from unbiassed basic data may give a better indication of a population characteristic than could be obtained from an unbiased estimate[1].) The authors of the APECITA study add together the estimates from complete responses, from grossed-up incomplete responses and the 'raw' results from responses that were not judged sufficiently representative to be grossed-up, and propose that the resulting aggregates be regarded as minimal estimates of future manpower needs. Before considering this further, the basic relationships underlying the whole exercise should be re-stated.

BASIC RELATIONSHIPS

13. The total number of trained manpower needed in, say, 1967 (L_{67}) is equal to the total number in 1962 (L_{62}) *less* 'wastage' through death, retirement and other causes in the interval 1962-67 (W) *plus* replacements (R) *plus* new posts needed by 1967 (N) *less* abolished posts 1962-67 (A). Given that in the present

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[1] The necessary condition is that, for a given level of probability, the confidence limits associated with a biassed method of estimation are narrower than those associated with an unbiased estimation method.

context, in total the number of new posts (N) will exceed the number of abolished posts (A), then L_{67} can be expressed either as—

$$L_{67} = L_{62} - W + R + (N - A) \quad \ldots\ldots\ldots\ldots \quad (i)$$

or as

$$L_{67} = L_{62} - W + (R - A) + N \quad \ldots\ldots\ldots\ldots \quad (ii)$$

This re-arrangement may seem trivial but it is important to use one expression or the other consistently in building up the total estimate. It should also be noted that the total amount of trained manpower that must be provided by 1967 is not just N—A but R + (N—A) or (R—A) + N.

14. In considering the validity of the minimal estimate proposed in the APECITA study, one should distinguish between the absolute number of new posts (N), abolished posts (A) and replacements (R), and the rates of change through time of those parameters. If one treats the problem in terms of expression (*i*) above, then the APECITA minimal estimate of net new posts (N—A) may conceivably be too high simply because nothing at all is known about the number of abolished posts (A) among refusals in that part of the field for which responses were judged to be unrepresentative. (For the moment, possible biases in grossed-up incomplete responses are assumed to be nil, at least in their net effect.) On the other hand, the number of losses through death, retirement and other causes (W) would be a true minimum estimate, *all* of whom would have to be replaced (because expression (*i*) is being used). If instead, expression (*ii*) were to be used, then the number of new posts (N) would be a valid minimum estimate—again ignoring grossing-up biases—but the number of net replacements (R—A) might be an over-statement. As regards the rate of change in the number of new posts, whether on a gross (N) or net (N—A) basis, this rate could be in error in amount, and for those segments of the field that are particularly affected by 'unrepresentative' incomplete response, the estimated rate of change could conceivably even be in the wrong direction, though this seems *prima facie* unlikely. (In fact, the APECITA study uses formulation (*i*) above, and recognises fully the great uncertainty surrounding the results of the ungrossed-up replies.)

REPLACEMENTS

15. The study does not explicitly include replacements in its final *aggregate* forecast of trained manpower needs though it does indicate the number of replacements likely to be required in each segment of the field. These estimates are derived directly from analyses by 5-year age-groups of the reported 1962 numbers of 'cadre' staff and the assumption that all those and only those who in that year were aged 60 or more will have ceased work by 1967. It is of interest to note the difference between the figures obtained in this way and the estimate one would obtain by assuming that since the average duration of working life is, say, 40 years, therefore 1/40th or 2½ per cent of the labour force cease work each year i.e. 1/8th or 12.5 per cent cease work every 5 years. In fact, over all the field for which complete or grossed-up information was available, the proportion of the total 1962 cadre labour force aged 60 or more was not 12.5 per cent but only 7 per cent. This difference represented about 2,300 persons or about 13 per cent of the estimated total number of net new posts for which people would need to be trained. It is obviously most important to know the actual age distribution by 5- or 10-year age-groups for the labour force for which projections are being made. The separate distributions for the various segments of the field studied by

APECITA, and for the whole labour force in question, revealed strikingly how false would have been the assumption of an approximately even percentage distribution between age-groups that is implicit in using the reciprocal of career-length to estimate wastage.

16. The very uneven age-distributions encountered call for a number of other comments. Three of these distributions are shown below:

AGE RANGE	PERCENTAGE IN EACH RANGE		
	A	B	C
20-29	3	29	—
30-39	37	48	11
40-49	16	18	52
50-59	44	4	37
60-65	—	1	—
	100	100	100

Distribution A appears reasonably even, and could relate to a fairly static segment of the field, with a post-war short-fall in recuitment (that will raise a replacement problem not in five but in ten years' time), with recruitment occurring primarily among more experienced candidates rather than among new graduates, and with retirement taking place at or very shortly after age 60. ("Graduates" is here used to mean a person who has completed a post-secondary course of formal training necessary in order to become cadre staff.) Distribution B could relate to a new and rapidly growing segment with recruitment both of new graduates and of more experienced candidates, and with more than enough automatic replacement of wastage. Alternatively, this distribution could be interpreted to show heavy losses of staff in their early forties, and this is in fact what has been happening in the particular segment to which these figures relate. Distribution C could reflect a contracting segment that faces either an acute recruitment problem or the certainty of extinction or absorbtion by another segment, although it seems to have no immediate replacement problem among its senior (and presumably older) staff. This distribution actually comes from an organisation whose future has been somewhat uncertain. The conclusion to be drawn from these considerations is that it is highly desirable to have data on age-distribution for at least two points of time in the past 5-10 years in order to see which age-groups after the first receive recruits, and which age-groups before the last are reduced by wastage.

"AUTODIDACTS"

17. A problem that is related both to the estimation of replacements for 'wastage' (R) and to the estimation of the net number of new posts (N—A) is that of how to treat the numbers of cadre staff who have acquired the know-how needed for the proper exercise of their present responsibilities entirely through experience of lower levels of responsibility and through assisting and maybe deputising for formally trained senior staff, possibly supplemented by private study. According to the APECITA survey, this category accounts for a remark-

ably high proportion of cadre-staff in French agriculture (see French study in the present report, Table 7), and while the proportion depends upon how one defines "cadre", the proportion may well be significantly high in other countries too. Over the whole field for which complete or grossed-up returns were available in the APECITA survey, the net increase between 1962 and 1967 in cadre posts (i.e. new posts *less* abolished posts, or N—A) that need formal training is forecast at about 18,500 (18,487) but the number of autodidacts is expected to fall by about 4,500 (4,533). Thus in another meaning of the word "net", the net increase in the *total* number of cadre posts—whether the holders need formal training or an equivalent amount of 'know-how' obtained through experience and/or private study— is expected to be only about 14,000 (13,954). (For simplicity of cross-reference, the original APECITA figures are shown in brackets.) It might thus seem that the drop of about 4,500 should be treated as equivalent to 'abolished posts', yielding a true 'net' training need of only about 14,000. One must, however, distinguish between the overall *net change* between 1962 and 1967 (or, in more general terms, between the beginning and the end of the forecast period) in the total cadre labour-force and the *total inflow* of trained cadre staff that—if the forecasts are accepted, for the purpose of the present discussion, as correct—will be needed. Just as, if we ignore the autodidacts, it is the total inflow R + (N—A), and not just N—A, that measures the size of the required output from the formal training system, so also when the autodidacts are taken into account, the fact that they are expected to fall by a certain number does not mean that their replacements need not be trained (subject to one assumption: see below): the formally trained replacement who succeeds to a post relinquished by an autodidact is just as much one more unit to be trained as is the replacement for a trained man who ceases work.

18. The assumption just made implicitly is that the post vacated by an autodidact who is not replaced by another autodidact is not itself abolished. Alternatively, we can define all posts occupied by autodidacts who are replaced by formally trained successors as "abolished posts" and we can postulate a corresponding number of "new posts" for formally trained cadre staff. This brings us back to the necessity of making quite clear in what ways reductions (through wastage or abolished posts) can be offset against increases (through new posts). By an extention of the symbols used previously, let the superscripts *t* and *a* denote "formally trained" and "autodidact" respectively.

Then $L_{62} = L^t_{62} + L^a_{62}$ .... (*iii*)
and $L_{67} = L^t_{67} + L^a_{67}$ .... (*iv*)

and by analogy with the previous expression (*i*) for L_{67} we can

say $L^t_{67} = L^t_{62} - W^t + R^t + (N^t - A^t)$ .... (*v*)
and $L^a_{67} = L^a_{62} - W^a + R^a + (N^a - A^a)$ .... (*vi*)

so that when, in accordance with the definitions in (*iii*) and (*iv*), we add (*v*) and (*vi*), we get

$L_{67} = L_{62} - (W^t + W^a) + (R^t + R^a) + (N^t - A^t) - (A^a - N^a)$ .... (*vii*)

In expression (*vii*), the terms in the last bracket have been interchanged and the overall sign changed so as to reflect more simply the effect of a net fall in the number of autodidacts.

19. Expression (*vii*) illustrates the point made in para 17, namely that the number of formally trained cadre is not reduced by the amount of the fall in

autodidacts: by definition the fall in the number of autodidacts (defined as "abolished posts") is partly, and maybe wholly, compensated by an increase in the number of new posts for formally trained cadre staff.

20. If the age-distribution of autodidacts in the 1962 cadre stock is known separately from the age-distribution of the whole 1962 cadre stock, then—subject to what was said previously about the interpretation of age-distributions—the number of replacements can be estimated separately for the formally-trained cadre staff, and the forecast net fall in the need for autodidact cadre staff can be offset against the estimated number of replacements for wastage of autodidacts. This is illustrated in the following re-arrangement of expression (*vii*) when for simplification we put $A'^{a} = \mathrm{A}^{a} - \mathrm{N}^{a}$:

$$\mathrm{L}_{67} = (\mathrm{L}_{62} - \mathrm{W}^{t} + \mathrm{R}^{t}) - \mathrm{W}^{a} + (\mathrm{R}^{a} - A'^{a}) + (\mathrm{N}^{t} - \mathrm{A}^{t}) \ldots\ldots\ldots\ldots\ldots \quad (viii)$$

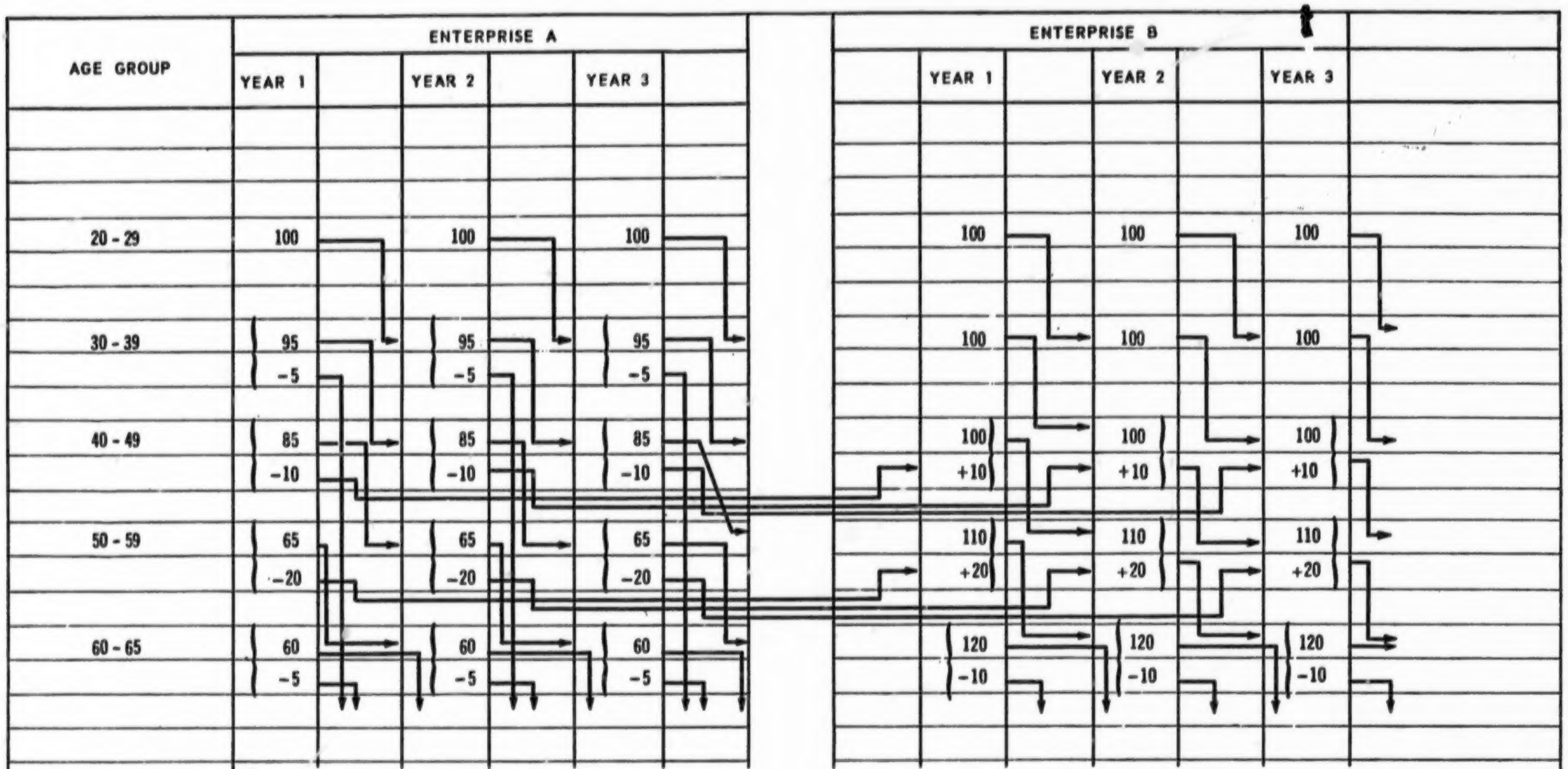
The needed inflow of formally trained staff is $\mathrm{R}^{t} + (\mathrm{N}^{t} - \mathrm{A}^{t})$. Although the inflow and outflow of autodidacts have no direct (see below) bearing on the *training* problem, it is of interest to note in the general *manpower* context that if A'^{a} equals or exceeds W^{a}, then no autodidacts are needed for replacements. The substantive conclusion of this part of the discussion is, however, that it is highly desirable to know separately the age-distribution of the autodidacts in order to estimate to what extent the projected fall in the total number of autodidacts will occur through ordinary wastage, and to what extent the fall may need to be brought about by other means.

21. This leads back to the rather too-sweeping statement that autodidacts present no formal training problem. The extent to which this type of cadre has not presented a training problem *in the past* depends on precisely how one defines 'cadre', on whether or not those concerned had any schooling at all, and on whether, and if so to what extent, they received schooling and maybe even formal training in skills appropriate to occupations other than that in which they are now engaged. More relevant to agriculture's *future* needs for trained manpower is the extent to which part of the projected fall in the number of autodidacts—viz. that part that will not be brought about by 'wastage'—may provide part of the input to the training system for producing formally qualified cadre. The duration and type of training needed to produce a given total output of cadre could be influenced quite considerably by the age, experience and existing 'know-how' of the students entering the system. Here again, a knowledge of the age-distribution of the existing stock of autodidacts would be very helpful.

PARASITIC RECRUITMENT AND 'RIPPLE' EFFECTS

22. In discussing the problem of interpreting age-distributions, mention was made of recuitment above the minimum age at which some recruits are taken on. Variations in the age-distribution of recruits and in the implied or assessed qualification-cum-experience characteristics of recruits in different age-groups for different segments of the total field studied could throw light on the 'echo' or 'ripple' effects of a given pattern of future needs in one particular segment. The APECITA study draws attention to this and the phenomenon should be further explored. The APECITA study gives the example of enterprise B recruiting highly-qualified staff who, to be eligible for recruitment, must have had wide experience in the same or a related segment of the field. Normally such staff are drawn from other enterprises, A, C, D. which experience a consequential 'wastage' through resignations below the normal retirement

MODEL OF 'PARASITIC' RECRUITMENT


AGE GROUP
ENTERPRISE A
YEAR 1
YEAR 2
YEAR 3
ENTERPRISE B
YEAR 1
YEAR 2
YEAR 3
20 - 29
30 - 39
40 - 49
50 - 59
60 - 65
100
95
-5
85
-10
65
-20
60
-5
100
100
100
+10
110
+20
120
-10

Enterprise A. Recruits only at 20-29
Wastage of unsuitable recruits in next decade.
Losses of experienced men to Enterprise B subsequently.

Enterprise B. Recruits at 20-29 but also takes on experienced men, 'trained' by Enterprise A, at ages 40-59. More selective recruitment at younger ages and no wastage among that group.

Both enterprises : Stable total cadre staff.

age and, if this pattern of losses is fairly stable through time, it would be revealed by a comparison of the age/qualification distribution of cadre staff in the 'importing' and 'exporting' enterprises at two points of time. Since both enterprise B and enterprises A, C, D. will *all* record these staff gains and 'loss-generated' needs as requirements, the same manpower requirement will be recorded twice or more, depending on how many enterprises are involved in 'gaining' and 'replacing' a particular individual during the period covered by the forecast. For a single year, one might think that the extent of this double- or multiple-counting could be estimated by the average annual number of times cadre-staff of given levels change their employer, and one would not *prima facie* expect this number to be very high on an annual basis but over a 5-year period the exaggeration of true manpower needs could conceivably be significant. The situation is however a little more complicated because the senior staff losses experienced by one enterprise to another may be made up by internal promotion or by partial or complete replacement through direct recruitment at similar or lower levels from other enterprises. The qualifications needed by the recruits who enter the labour market for the first time, to meet the indirect needs generated by 'parasitic' recruitment by one enterprise from another may differ from the qualifications required by the senior staff recruited 'parasitically'. This double-count problem is analagous to that arising from "inter-farm sales" or "intermediate output" and could be avoided by recording only that part of requirements R+(N—A) that represents recruitment of persons entering the formally trained cadre supply for the first time *plus* such other portion of R+(N—A) as requires further formal training between leaving one job and commencing another. This problem is illustrated in the diagram.

OTHER DOUBLE-COUNTING

23. A further possible cause of double-counting is the existence of part-time staff (e.g. accountants and some skilled farm workers) who serve two or more enterprises or farms, where both or all the enterprises (or farms) may report their expected needs of such staff without stating that only part-time work is involved. This difficulty could be solved, in principle, by asking respondents only to record staff who devote 50 per cent or more of their time to work for the respondent. Such an approach would be simpler than asking all enterprises to record all their staff needs in "full-time equivalents".

CADRE INPUT AND TRAINING OUTPUT

24. When the total estimated annual requirements of cadre staff have been estimated, it should be remembered that the total 'stock' of students in the formal training system will have to be greater than the number given by multiplying the average course-length by the required annual output of graduates. This will be so not only because of drop-out—i.e. students who do not complete their training for one reason or another—but also because of the temporary or permanent 'export' for overseas service of part of the output of graduates, and the training of overseas students who come to the country concerned in order to be trained for work in their own country. At the same time, a country may be able to 'import', temporarily or permanently, cadre staff who have been trained abroad.

25. In this connection it may sometimes be necessary to distinguish between the number of cadre who should be trained to meet the future *needs of home*

agriculture and the number who will be required to meet the future needs of work relating to agricultural and food products, whether of *domestic or imported* origin, in the country in question. The latter broader field would include work on imported tropical products that do not provide any inputs for home agriculture (e.g. tea, coffee, cocoa), but the boundary is far from clear. Cadre staff in the flour-milling or sugar refining industry may be working partly or wholly on imported materials, whilst tropical products such as oilseeds provide important feed inputs for home agriculture.

26. The most important single conclusion to be drawn from this discussion is that the collection of information by questionnaire through a complete census can be a hazardous undertaking if cooperation is voluntary and therefore uncertain. Such an approach may nevertheless be of great value in an almost uncharted field of knowledge, if only to provide a basis for more thorough investigation later. APECITA, who were pioneers in this field in France, would agree completely with this. It may well be, however, that such further investigation could be more efficiently and economically carried out by means of a suitably designed sample enquiry than through another attempt at a complete census. This alternative method is discussed further below.

SAMPLING AS A METHOD OF DATA COLLECTION

27. As was emphasised in the preceding discussion, a serious limitation of incomplete results in a census is the absence in most instances of any proper basis for deriving aggregate estimates, and in addition there is no means of knowing how much confidence to place in crudely grossed-up results: in more formal terms, the range within which the true result probably lies—with (say) 95 per cent probability— cannot be quantified. The greater efficiency and economy of a properly designed sample survey arises from the possibility of concentrating explanation, persuasion and 'chasing' on a more limited front and from the fact that, if the survey is properly conducted, the range on either side of the derived population estimates within which the true population values lie, can be calculated with known probabilities of being correct. It is true that low response rates in a sample enquiry raise the same questions of possible bias as in the case of an attempt at a complete census, but in general response rates in a sample survey should be better than in a voluntary census for the reason mentioned above. It is not the purpose of this section to give an account of the theory and practice of sample surveys[1] but to discuss the application of the basic principles to the sort of problem with which the present report is concerned.

PURPOSE OF THE ENQUIRY

28. An enquiry among actual and potential employers of formally trained staff has three distinct but closely related aims, namely to investigate:

a) the occupation/training structure of the labour force now and (say) five years previously;

b) the occupation/age structure of the labour force now and (if possible) five years previously; and

c) the expected total labour force and its occupation/training structure in (say) five years' time.

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[1] Reference should be made to: Studies in Method Series F No. 9, *A Short Manual on Sampling*, U.N. Statistical Office, 1960, and to the works cited in that source.

The importance of having the age structure at two points of time has been explained in paragraph 16, and the problems surrounding respondent's own estimates of their 'cadre' needs in five year's time have been discussed too.

'POPULATION' TO BE COVERED

29. There are five main sub-divisions of the 'population' (in the statistical sense) to be investigated, but for some of these, two or more sub-populations may need to be considered separately depending on the institutional arrangemants in the country concerned:

a) *The farm labour force:* This consists of farm *operators* (i.e. "chefs d'exploitation" or the persons responsible for the day-to-day management of a holding: such persons may be landlords or tenants) and their family and/or hired labour. Since the enquiry would probably be based on the selection of holdings and the collection of information from *holders*, (i.e. "exploitants" or the persons legally responsible for, and bearing the economic risks of a holding), it is important that where holders themselves do not know e.g. the ages or educational levels of their labour force, this information should be sought by direct interview with the individuals concerned. Those holders who employ hired managers are themselves unlikely to be operators—indeed this is the main distinction between 'holder' and 'operators' (such holders include corporations as well as individual persons)—and in this case need not be asked to answer questions *about themselves*, but such holders may be better placed than their hired manager to answer questions about the likely future size and composition of their total labour force.

b) *Enterprises engaged in the marketing and processing of farm produce.* Such enterprises may be statutory marketing boards, farmers' coöperatives or privately owned commercial undertakings. It should be noted that enterprises concerned with the handling, processing and marketing of imported agricultural products may also need to be covered by the enquiry.

c) *Enterprises engaged in the supply of goods and services to the agricultural sector.* Such enterprises include coöperative buying agencies as well as private commercial dealers, processors, manufacturers and importers of machinery, equipment, feedingstuffs, fertilisers and other agricultural chemicals, and undertakings for the use of farm equipment under coöperative or contractual arrangements. Coöperative and commercial credit services should also be covered in this category.

d) *Research and advisory services.* This group will cover not only the official advisory services and the research activities undertaken by government, university and other independent establishments, but also (where they exist) coöperative or private advisory services and research work taking place in the business enterprise sector (e.g. by the food manufacturing industry, the feedingstuffs and agricultural chemicals industries).

e) *Agricultural education*: This part of the field is best kept separate even though (at the higher levels) it is likely to be very closely bound up with research activities. Private educational establishments that give agricultural training should not be overlooked.

30. In addition to these main areas for investigation, there are others whose importance will vary between countries:

f) Professional organisations (e.g. Farmers' Unions, Coöperative Federations, Manufacturers' Associations)
g) Government services not already covered (e.g. Veterinary services, price and income support agencies).
h) Persons coming from overseas for training.
i) Nationals to be trained for service overseas.

SOURCES OF BASIC DATA

31. These various sub-divisions of the total 'population' cannot be properly investigated by sample survey unless comprehensive and up-to-date 'frames' or registers exist from which samples can be drawn. The following are possible sources of such information:

Census of agriculture and/or of population
Census of production and/or of distribution
Registers of coöperatives
Registers of trade associations and trade unions
Compulsory social insurance schemes
Professional organisations
Research councils
Government departments

32. As has just been pointed out, it is necessary—indeed essential—that the 'frame' used for selecting a sample from each part of the population should be up-to-date. This may raise problems where the only basic data available are, for example, those collected in a census of some years ago. The task and cost of bringing up-to-date the basic information may be lightened by means of cluster sampling, though this will of course increase the sampling error if the total sample size is kept constant.

SAMPLING ERROR

33. It must be emphasised (for the non-statistician reader) that this 'sampling error' is a measure of the uncertainty due to the fact of using a sample rather than a complete census, and that this 'error' or margin of uncertainty is an advantage rather than weakness of this method of estimation: not only can this margin be quantified but (*a*) its size can be set at whatever level is desired by means of increasing the sample size and/or varying the sample design (*provided* that the means exist for selecting and investigating a sample of the size and design decided upon); and (*b*) the probability that the population value lies within a specified range (usually defined as twice or three times the sampling error) is known. One of the main practical problems in planning a sample enquiry is deciding on the most reasonable balance between, on the one hand, the cost of planning and carrying out the enquiry, and on the other, the cost of being in error in the results—in other words, between the funds, facilities and personnel available to execute the survey, and the size of error margin one can accept with (say) a 5 per cent chance that the true error is greater. The sample design as well as, or instead of, sample size may be altered in order to increase the reliability or reduce the cost of the results: 'stratification' (e.g. ranking enterprises according to size of cadre labour force) ensures greater representativeness for a given

size of sample, and 'clustering' (e.g. selecting counties from a register of counties and then selecting farms only within selected counties) reduces the cost of travel for a given sample size. These are technical matters upon which the appropriate texts should be consulted or specialised advice sought, and it is worth underlining the fact that apparently cheaper and less rigourous preparation and execution of surveys may in the end amount to false economy.

DATA COLLECTION

34. A further question of major importance from the point of view of the cost of a survey is whether the information should be sought by personal visit or by postal questionnaire. This is not the place to discuss in detail the merits and weaknesses of these two methods but it is clear that besides affecting the cost of carrying out an enquiry, the choice of method may also affect the design of the questionnaire: the precise form of words, and even the order of questions, most suitable for questions to be addressed orally to interviewees is not necessarily the most appropriate for a questionnaire to be read by the respondent for himself. No more will be said here except to emphasise the importance of strict adherence to the sampling scheme; careful selection, training and supervision of investigators (if personal visits are decided upon); and several visits to "not-at-homes" (in the case of interviews) or several reminders to initial "refusals" (in the case of a postal survey).

THE QUESTIONNAIRE

35. The content and layout of the questionnaire deserve very careful attention: a poorly laid out questionnaire is likely to irritate the conscientious interviewer or respondent and to prejudice the hostile respondent. The questions should be simply and unambiguously phrased and the nature of the possible answers should be made clear, but at the same time, every care must be taken to avoid influencing respondents to give the answers they think will please or impress. Rather than enunciate more general principles, a possible questionnaire will now be considered in more detail (see Example II).[1]

36. It is likely that one of the criteria used in designing and selecting the sample will have been some indicator of size of enterprise, and in the analysis of the results, undoubtedly the relationship between size of enterprise and changes in the size and educational attributes of the labour force will be of interest. For both these reasons, some suitable indicator of size—namely the indicator used in selecting the sample (e.g. labour force or turnover or farm area)—should be asked for. The replies will also be of use in checking on the representativeness of the responses.

37. In the case of farm operators, two questions are suggested for age. These are intended to serve as mutual checks. Sometimes a person will remember his year of birth better than his age, or *vice versa*, and if only one question is put, some respondents will give the wrong answer. The two questions should ensure that the correct information is given (provided of course that the interviewer does not simply record one answer and deduce the other after the interview is completed).

---

[1] This example is based partly upon a layout suggested by Dr. Petrini.

38. The questions on education raise a more fundamental problem concerning precisely what information should be asked for. As the OECD *Handbook of Statistical Needs for Educational Investment Planning* points out, educational attainment may be measured in at least four ways:

i) the highest level of training completed;
ii) certificates, diplomas or degrees held;
iii) the number of years of full-time formal education completed; or
iv) the age of completion of full-time formal education;

The *Handbook* recognises the difficulties raised by part-time training, informal training in the course of gainful work, and by the facts that incompleted courses and courses completed but without formal certificates at the end can transmit useful knowledge to participants.

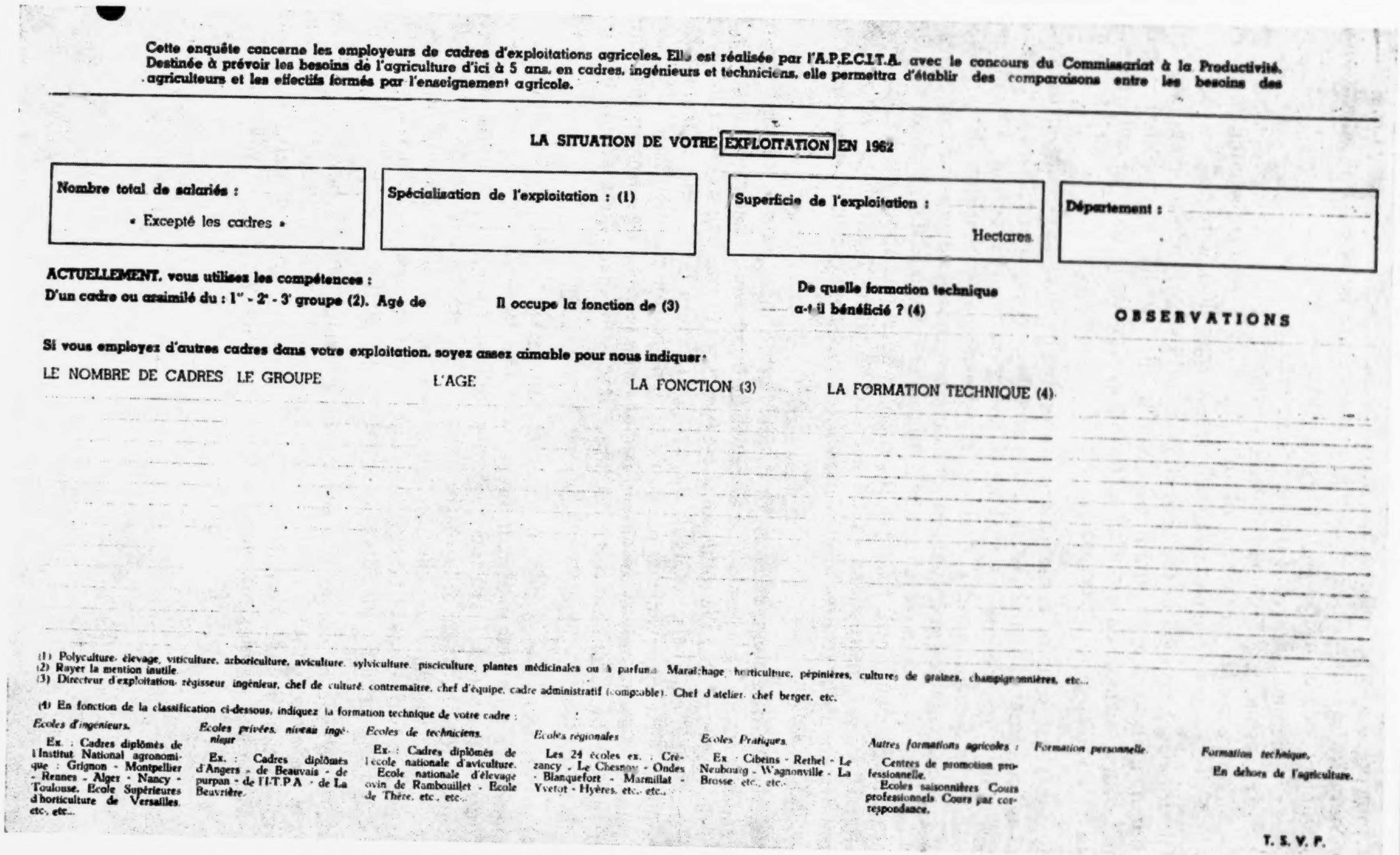
39. These sorts of complication are probably more important in the case of agriculture than in the cases of other sectors or occupations, and there is also the difficulty sometimes of ranking different methods of formal agricultural training in ascending order of 'level'. The *Handbook* recommends that number of grades completed and qualifications obtained should be given first priority in the collection of data on educational attainment. Despite the practical difficulties already mentioned, Example II proposes questions about the highest level attained. Clear instructions would need to be given to investigators in each country about the relative level of the various types of agricultural training in its particular system.

40. The questionnaire asks for details both of agricultural training and of general training. This means that there will be some overlap between the coverage of the replies so that the totals for these two types of training will not (unless by coincidence) equal the totals in the age distribution table. This is from some points of view inconvenient, and could be avoided if non-agricultural education is enquired about only in the case of persons who received no formal agricultural training. Whichever basis is decided upon, it must be made quite clear to respondents how they are to complete the tables.

41. It will be seen that the questionnaire asks for the age distribution of manpower now and five years previously. The 1960 distribution must not of course be derived from the 1965 distribution by merely shifting numbers 'backwards' between cells of the table: as is emphasised in paragraph 16, it is most important to collect data on the actual age distribution of manpower at each of two points of time. If this cannot be done in a single survey, it should be done by repeating the survey five years (or so) later.

42. Whenever possible, a survey questionnaire should be tested 'in the field' before a full scale enquiry is launched. Such a test may reveal unexpected ambiguities or unanswerable questions, as well as provide a useful method of selecting and training interviewers (if personal interviews are decided upon).

Example I



Cette enquête concerne les employeurs de cadres d'exploitations agricoles. Elle est réalisée par l'A.P.E.C.I.T.A. avec le concours du Commissariat à la Productivité. Destinée à prévoir les besoins de l'agriculture d'ici à 5 ans, en cadres, ingénieurs et techniciens, elle permettra d'établir des comparaisons entre les besoins des agriculteurs et les effectifs formés par l'enseignement agricole.

LA SITUATION DE VOTRE EXPLOITATION EN 1962

Nombre total de salariés : « Excepté les cadres »	**Spécialisation de l'exploitation : (1)**	**Superficie de l'exploitation :** Hectares	**Département :**

ACTUELLEMENT, vous utilisez les compétences :

D'un cadre ou assimilé du : 1ᵉʳ - 2ᵉ - 3ᵉ groupe (2). Agé de **Il occupe la fonction de (3)** **De quelle formation technique a-t-il bénéficié ? (4)**

OBSERVATIONS

Si vous employez d'autres cadres dans votre exploitation, soyez assez aimable pour nous indiquer :

LE NOMBRE DE CADRES	LE GROUPE	L'AGE	LA FONCTION (3)	LA FORMATION TECHNIQUE (4)

(1) Polyculture, élevage, viticulture, arboriculture, aviculture, sylviculture, pisciculture, plantes médicinales ou à parfums. Maraîchage, horticulture, pépinières, cultures de graines, champignonnières, etc...

(2) Rayer la mention inutile.

(3) Directeur d'exploitation, régisseur ingénieur, chef de culture, contremaître, chef d'équipe, cadre administratif (comptable). Chef d'atelier, chef berger, etc.

(4) En fonction de la classification ci-dessous, indiquez la formation technique de votre cadre :

Ecoles d'ingénieurs.

Ex. : Cadres diplômés de l'Institut National agronomique : Grignon - Montpellier - Rennes - Alger - Nancy - Toulouse. Ecole Supérieures d'horticulture de Versailles, etc., etc...

Ecoles privées, niveau ingénieur

Ex. : Cadres diplômés d'Angers - de Beauvais - de purpan - de l'I.T.P.A. - de La Beuvrière.

Ecoles de techniciens.

Ex. : Cadres diplômés de l'école nationale d'aviculture. Ecole nationale d'élevage ovin de Rambouillet - Ecole de Thère, etc., etc...

Ecoles régionales

Les 24 écoles ex. : Crézancy - Le Chesnoy - Ondes - Blanquefort - Marmillat - Yvetot - Hyères, etc., etc..

Ecoles Pratiques.

Ex : Cibeins - Rethel - Le Neubourg - Wagnonville - La Brosse, etc., etc.

Autres formations agricoles :

Centres de promotion professionnelle.

Ecoles saisonnières Cours professionnels Cours par correspondance.

Formation personnelle.

Formation technique.

En dehors de l'agriculture.

T. S. V. P.

VOTRE EXPLOITATION TELLE QU'ELLE SE SITUAIT EN 1957

Nombre total de salariés :
(Excepté les cadres)

Spécialisation de l'exploitation (1)

Superficie de l'exploitation : Hectares

OBSERVATIONS

Il y a 5 ans, vous utilisiez les compétences :

— D'un cadre ou assimilé du 1er - 2 - 3 groupe (2). Il occupait la fonction de (3)

De quelle formation technique avait-il bénéficié ? (4)

Si vous employiez à cette époque d'autres cadres dans votre exploitation, soyez assez aimable pour nous indiquer :

LE NOMBRE DE CADRES : LE GROUPE : LA FONCTION LA FORMATION TECHNIQUE :

LA SITUATION DE VOTRE EXPLOITATION TELLE QUE VOUS LA PREVOYEZ POUR 1967

Combien de salariés estimez-vous que vous emploierez. (excepté les cadres.)

Vous pensez spécialiser votre exploitation vers :

Vous pensez que votre exploitation par rapport à 1962 aura une superficie :
- **Inférieure,**
- **Equivalente,**
- **Supérieure (2).**

OBSERVATIONS

Pour chacun des 3 groupes de cadres, donnez-nous des indications concernant les matières sur lesquelles vous aimeriez que l'on insiste à l'avenir dans l'enseignement agricole, ex. : comptabilité, commerce, économie, droit, machinisme, etc., etc..

Dans 5 ans, vous estimez que vous utiliserez les compétences :

— D'une cadre ou assimilé du 1er - 2 - 3 groupe (2). Pour occuper la fonction de (3)

Quelle formation technique voudriez-vous qu'il reçoive ?

Si vous estimez que vous serez amené à employer plusieurs cadres dans votre exploitation soyez assez aimable pour nous indiquer :

LE NOMBRE DE CADRES LE GROUPE : (auquel ils devraient normalement appartenir) LA FONCTION : (qu'il devraient normalement tenir) (4) LA FORMATION TECHNIQUE (Souhaitable)

Prière de renvoyer ce questionnaire à l'ASSOCIATION POUR L'EMPLOI DES CADRES, INGENIEURS ET TECHNICIENS DE L'AGRICULTURE, 8, rue d'Athènes, Paris-9e
EN UTILISANT L'ENVELOPPE CI-JOINTE QUI VOUS DISPENSE DE TOUT AFFRANCHISSEMENT

Cette enquête **CONCERNE** tous les cadres de formations ou d'activités agricoles et para-agricoles. Elle est **REALISEE** par l'A.P.E.C.I.T.A. avec le concours du Commissariat à la Productivité. **DESTINEE** à prévoir les besoins de l'Agriculture, d'ici à 5 ans, en cadres, ingénieurs, et techniciens, elle permettra d'établir des comparaisons entre ces besoins et les effectifs formés par l'enseignement agricole.

EFFECTIFS ACTUELS

Secteur « 1 » :

Sous-secteur « 2 » :

Nom de l'Entreprise :

Nombre total salariés (y compris Direction, Cadres, Maîtrise) :

Département :

FONCTIONS « 3 »	REPARTITION PAR AGE							FORMATION					Autodidactes	Formation non agricole		OBSERVATIONS
	Sexe		20 à 29 ans	30 à 39 ans	40 à 49 ans	50 à 59 ans	60 à 65 ans	Ecoles d'Ingén. « 4 »	Ecoles privées niveau Ingén. « 5 »	Ecoles de Techniciens « 6 »	Ecoles Régionales	Ecoles Pratiques		Ingénieurs; Licenciés Etc...	Techniciens	
	M	F														

1. - **SECTEUR** ex : Secteur public, secteur organisations professionnelles, secteur production, etc.
2. - **SOUS-SECTEUR**, ex : Eaux et Forêts, Chambres d'Agriculture, Elevage, etc.
3. - **FONCTIONS** : Ne connaissant pas les attributions précises de vos différents cadres, nous avons pensé qu'il serait préférable que vous fixiez vous-même les diverses catégories qui conviennent. Ex. : Directeur, ingénieurs, agents techniques, etc.
4. - **ECOLES D'INGENIEURS**, ex. : I.N.A. - Grignon - Montpellier - Rennes - Alger - Nancy - Toulouse - Ecole de Laiterie de Nancy - Horticulture Versailles - E.S.A.A.T. - E.N.I.A.A. - Coetlogon-Rennes - Ecole de Brasserie et de Malterie de Nancy, etc.
5. - **ECOLES PRIVEES** : Niveau ingénieurs, ex. : Angers - Beauvais - Purpan - I.T.P.A. - La Beuvrière.
6. **ECOLES DE TECHNICIENS**, ex. : Ecoles d'Industries Laitières - Ecole nationale d'Aviculture - Ecole de Brasserie et de Malterie de Nancy, etc.

T.S.V.P.

Estimez-vous que la connaissance d'une langue étrangère soit souhaitable - Anglais, Allemand, Espagnol, Italien...

EFFECTIFS IL Y A 5 ANS ——— Nombre total salariés : ———

FONCTIONS	[illegible]		FORMATION					Autodidactes	Formation non agricole		OBSERVATIONS
	M	F	Ecoles d'ingénieurs	Ecoles privées niveau ingénieur	Ecoles de Techniciens	Ecoles Régionales	Ecoles Pratiques		Ingénieurs; Licenciés	Techniciens	

EFFECTIFS DANS 5 ANS

			hypothèse		hypothèse		hypothèse		hypothèse		hypothèse		hypothèse		hypothèse		hypothèse		
			favorable	défavorable	favorable	défavorable	favorable	défavorable	favorable	défavorable	favorable	défavorable	favorable	défavorable	favorable	défavorable	favorable	défavorable	

Prière de renvoyer ce questionnaire à l'ASSOCIATION POUR L'EMPLOI DES CADRES, INGENIEURS ET TECHNICIENS DE L'AGRICULTURE, 8, rue d'Athènes, Paris-9ᵉ.

Example II

SAMPLE ENQUIRY ON EDUCATION IN AGRICULTURE

A. Identification of respondent

Name:
Address:
Registered number of holding/establishment/organisation:

B. Background

AGRICULTURAL HOLDINGS

Area[1]: Arable and temporary grass:
Permanent grass..........:
Other...................:
Total...............:

Livestock[2]: Cattle:
Pigs .:
Scheep:

Type[3]:

OTHER ENTERPRISES

Number of employees[4]: Cadre:
Other:
Total :

Value of turnover[5]:

Type[6]:

C. Operator or manager

Date of birth:

Age last birthday:

Education and training[7]:

GENERAL		AGRICULTURAL[8]	
None	☐	None	☐
Primary	☐	Agricultural course in primary school	☐
Lower secondary	☐	Agricultural vocational school	☐
Upper secondary	☐	Special agricultural course, e.g. winter school	☐
Post-secondary, non-university	☐	Other, non-university	☐
University	☐	University	☐

D. Other staff

Age distribution

YEAR	FUNCTION[9]	UP TO 24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 & OVER	TOTAL
1960	Foremen											
	Cattlemen: Men....											
	Women .											
	Other specialised workers:											
	Men....											
	Women .											
	Other workers:											
	Men....											
	Women .											
	Total..........											
1965												
	Total...............											

Educational distribution: Agricultural training[7,8]

YEAR	FUNCTION[9]	AGRICULTURAL COURSE IN PRIMARY SCHOOL	FARM SCHOOL		AGRICULTURAL COLLEGE	TOTAL
1960	Foremen............					
	Cattlemen: Men....					
	Women .					
	Other specialised workers:					
	Men....					
	Women .					
	Other workers:					
	Men....					
	Women .					
	Total...........					
1965 1970		(As above)				

EDUCATIONAL DISTRIBUTION: GENERAL TRAINING[7]

YEAR	FUNCTION [9]	PRIMARY	LOWER SECONDARY		OTHER	TOTAL
1960	Foremen............					
	Cattlemen: Men....					
	Women.					
	Other specialised: workers: Men....					
	Women.					
	Other workers: Men....					
	Women.					
	Total...........					
1965						
	Total...........					
1970						
	Total...........					

---

1. As reported in latest census of land use.
2. As reported in latest census of livestock.
3. (Give list of types on questionnaire or to investigator, or classify later on basis of data in replies on area and livestock numbers.)
4. As reported in latest social insurance returns.
5. As reported (e.g.) in latest census of production or distribution.
6. (Give list or classify beforehand from (e.g.) sample frame).
7. Record in the box indicating the highest level reached.
8. The classification is illustrative and may need to be expanded. Clear instructions would need to be given to investigators in each country about the relative levels of the various types of agricultural training in its particular system.
9. (Function titles will depend on type of enterprise investigated.)

Appendix III

THE RELATIONSHIP BETWEEN ALTERNATIVE ESTIMATES OF ANNUAL RECRUITMENT NEEDS

by

W. N. T. Roberts

THE RELATIONSHIP BETWEEN ALTERNATIVE ESTIMATES OF ANNUAL RECRUITMENT NEEDS

by

W. N. T. ROBERTS

Let base-date population (or labour force) $= P_o$
Let forecast population (or labour force) $= P_1$
Let $P_1 = p.P_o$
Let average number of years' gainful employment ('average career length') $= t$
Let length of forecast period $= u$
Let $u = m.t$

Then the *average* annual number of recruits to the labour force is given by:—

$$\bar{K} = \frac{P_0}{t} - \frac{P_0 - P_1}{u}$$

$$= \frac{P_0}{t} - \frac{P_0(1-p)}{mt}$$

$$= \frac{mP_0 - P_0(1-p)}{mt}$$

$$= \frac{P_0(m-1+p)}{mt} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

The *terminal* annual number of recruits is

$$K_T = \frac{P_1}{t} = \frac{p.P_0}{t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

The relationship between these alternative estimators can be examined by considering the changes in the value of their ratio as p varies from zero to unity.

Now
$$\frac{K_T}{\bar{K}} = \frac{p.P_0}{t} \times \frac{mt}{P_0(m-1+p)}$$

$$= \frac{mp}{m-(1-p)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

Note that $mp = m—(1—p)m$ so that (*iii*) becomes

$$\frac{m-(1-p)m}{m-(1-p)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iiia)$$

It can now be seen that, when $p<1$ (which is the case),

if $m = 1$, (i.e. the length of the forecast period is the same as the average career length), $K_T/\bar{K} = 1$

$m > 1$, (i.e. the forecast period is longer than the average career length—which is unlikely). $K_T/\bar{K} < 1$

and if $m < 1$, (i.e. the forecast period is shorter than the average career length—which is probably the case in practice), $K_T/\bar{K} > 1$

provided in this last case that $m > 1-p$

i.e. provided that $p > 1-m$

In the present report, the projection periods considered are either 10 years or 20 years, and the average career-lengths are 30 years or 40 years. Hence, m is less than unity.

Graph 1 shows the ratio $K_T/\bar{K}$ for various values of p when $t = 30$ and $u = 20$ i.e. $m = \frac{2}{3}$. In this case,

$$\frac{K_T}{\bar{K}} = \frac{mp}{m-(1-p)}$$

$$= \frac{2p}{2-3(1-p)}$$

$$= \frac{2p}{3p-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (iv)$$

It will be seen that the ratio is positive for all likely values of p.

Graph 2 shows the values of this same ratio $K_T/\bar{K}$ when $t = 30$ and $u = 10$ i.e. $m = \frac{1}{3}$. In this case,

$$\frac{K_T}{\bar{K}} = \frac{p}{1-3(1-p)}$$

$$= \frac{p}{3p-2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (v)$$

For $m = \frac{1}{3}$, the condition $p > (1-m)$ becomes $p > 0.67$ and Graph 2 shows that when p falls below this level, $K_T/\bar{K}$ is not merely less than unity but takes high *negative* values when p is in the range of about 0.55 to 0.65.

Since $\bar{K}$ implies a continued decline in the labour force at the same absolute annual rate as during the forecast period, whilst K_T implies no decline at all beyond the end of that period, the true rate of annual recruitment at the end of that period almost certainly lies between $\bar{K}$ and K_T. A rough estimate of the true rate is given by the simple mean of $\bar{K}$ and K_T. Let us denote this mean by $\bar{\bar{K}}$.

Then $\bar{\bar{K}} = (K_T+\bar{K})/2$

From (*iv*), when $m = \frac{2}{3}$, $\bar{K} = K_T\left(\frac{3p-1}{2p}\right)$

so that

$$\bar{\bar{K}} = K_T\left(1+\frac{3p-1}{2p}\right)/2$$

$$= K_T\left(\frac{5p-1}{4p}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (vi)$$

Similarly from (*v*) when

$$m = \tfrac{1}{3}, \qquad \bar{K} = K_T\left(\frac{3p-2}{p}\right)$$

so that

$$\bar{\bar{K}} = K_T\left(1+\frac{3p-2}{p}\right)/2$$

$$= K_T\left(\frac{2p-1}{p}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (vii)$$

Thus with expressions (*vi*) or (*vii*), $\bar{\bar{K}}$ can be estimated directly from K_T and the assumed proportionate change in the total labour force during the projection period. Corresponding expressions can easily be derived for other career-lengths and projection periods.

Graph 2 also shows the ratio $\bar{\bar{K}}/\bar{K}$ for $m = \tfrac{1}{3}$ and for different values of p. The expression for this ratio is derived as follows:

From (*vii*), when $m = \tfrac{1}{3}$, $\bar{\bar{K}} = K_T\left(\frac{2p-1}{p}\right) = \frac{pP_0}{t}\left(\frac{2p-1}{p}\right)$

$$= \frac{P_0}{t}(2p-1)$$

and from (*i*), $\bar{K} = \frac{Po}{mt}(m—1+p)$, and putting $m = \tfrac{1}{3}$

this becomes $\frac{3P_0}{t}(p-\tfrac{2}{3}) = \frac{3P_0}{t}\left(\frac{3p-2}{3}\right)$

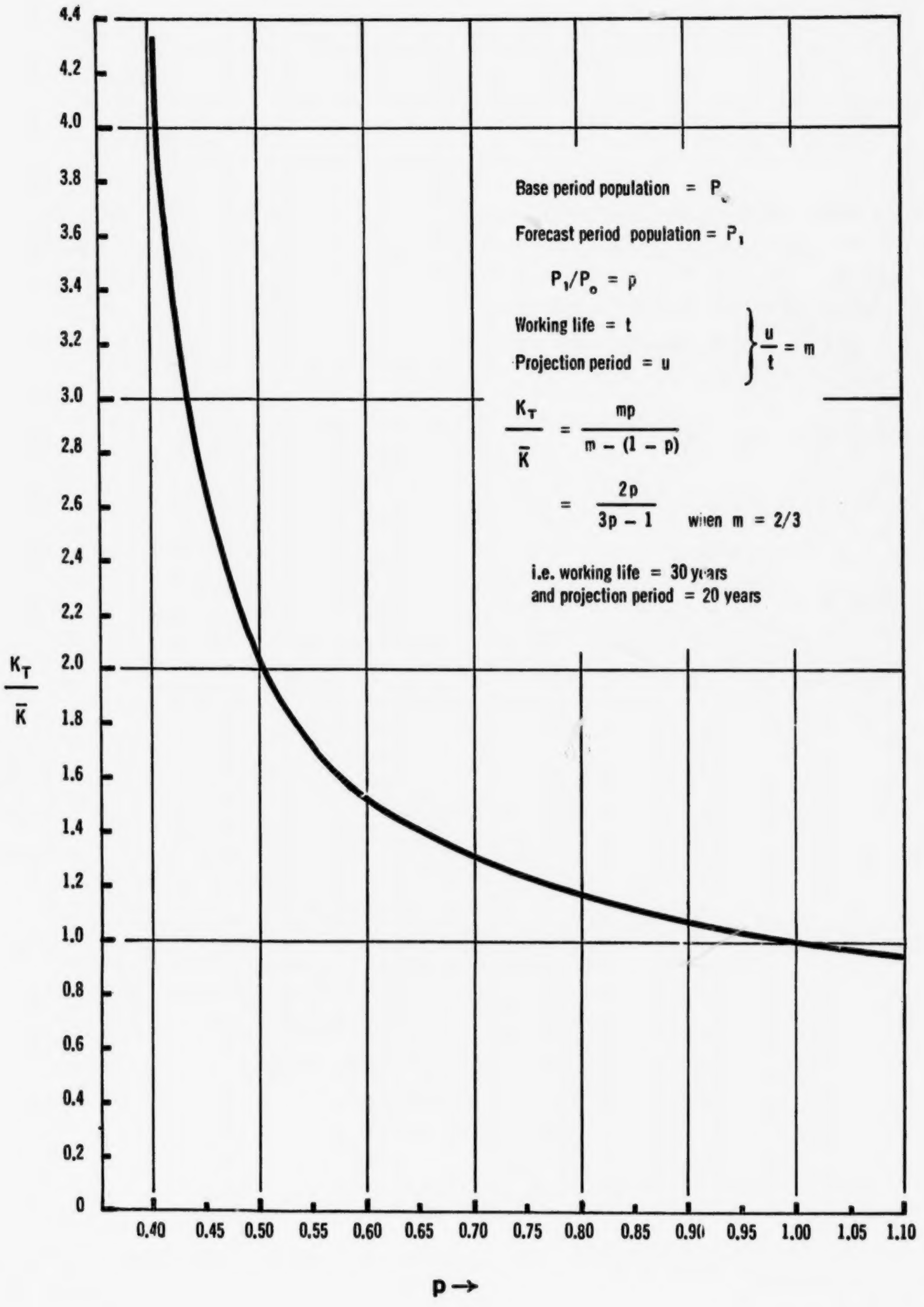
$$= \frac{P_0}{t}(3p-2)$$

Hence

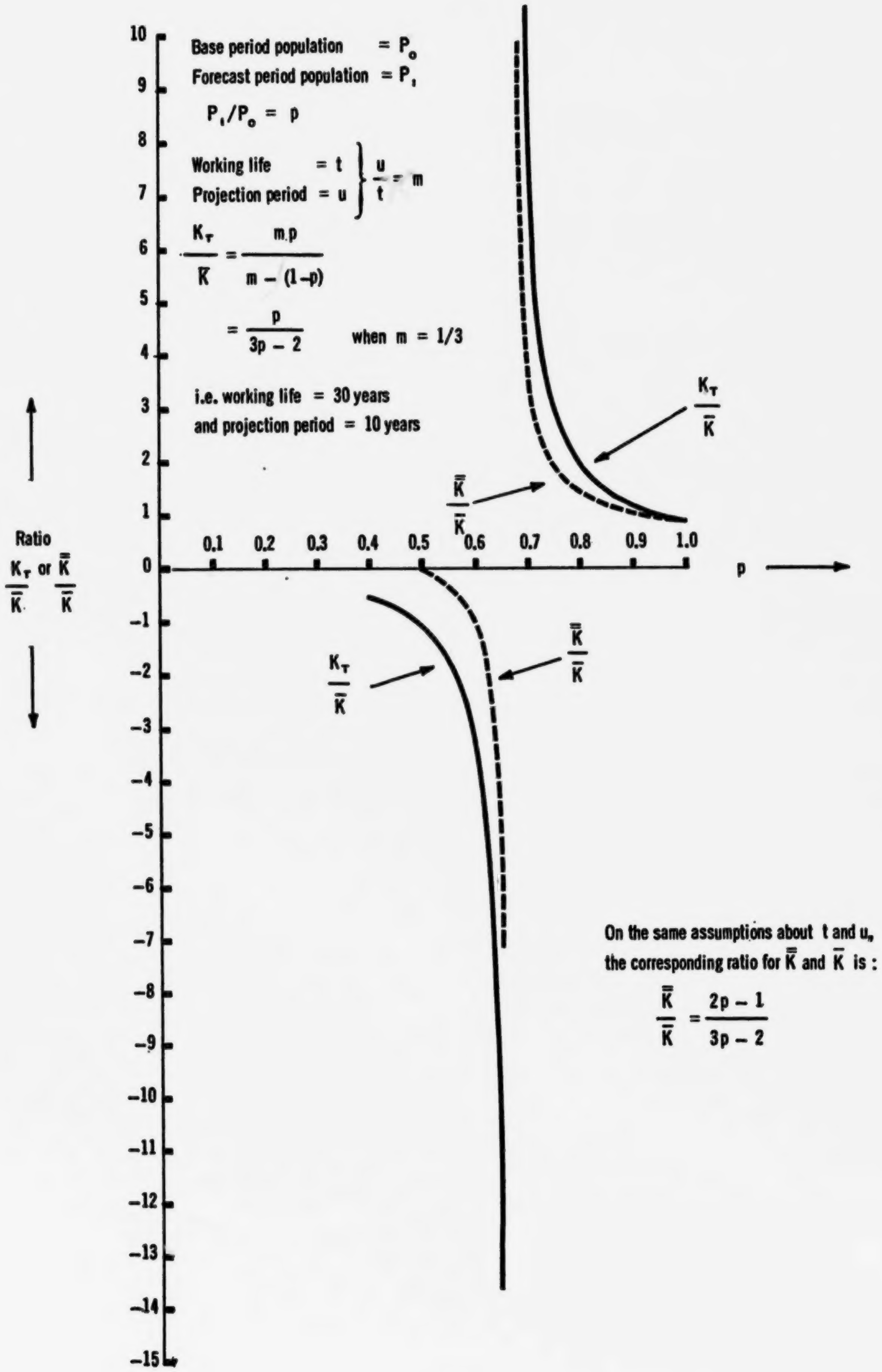
$$\frac{\bar{\bar{K}}}{K} = \frac{2p-1}{3p-2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (viii)$$

Graphs 3 and 4 show the postulated manpower totals described in the main text and the annual recruitment flows derived from them by means of the estimators $\bar{K}$, K_T and $\bar{\bar{K}}$. Two other estimators are also illustrated, namely demographic projections K_D (described in the Swedish study), and an adjusted $\bar{\bar{K}}$ obtained by multiplying the calculated values of $\bar{\bar{K}}$ by the ratio $K_D/\bar{\bar{K}}$ as computed for the base period.

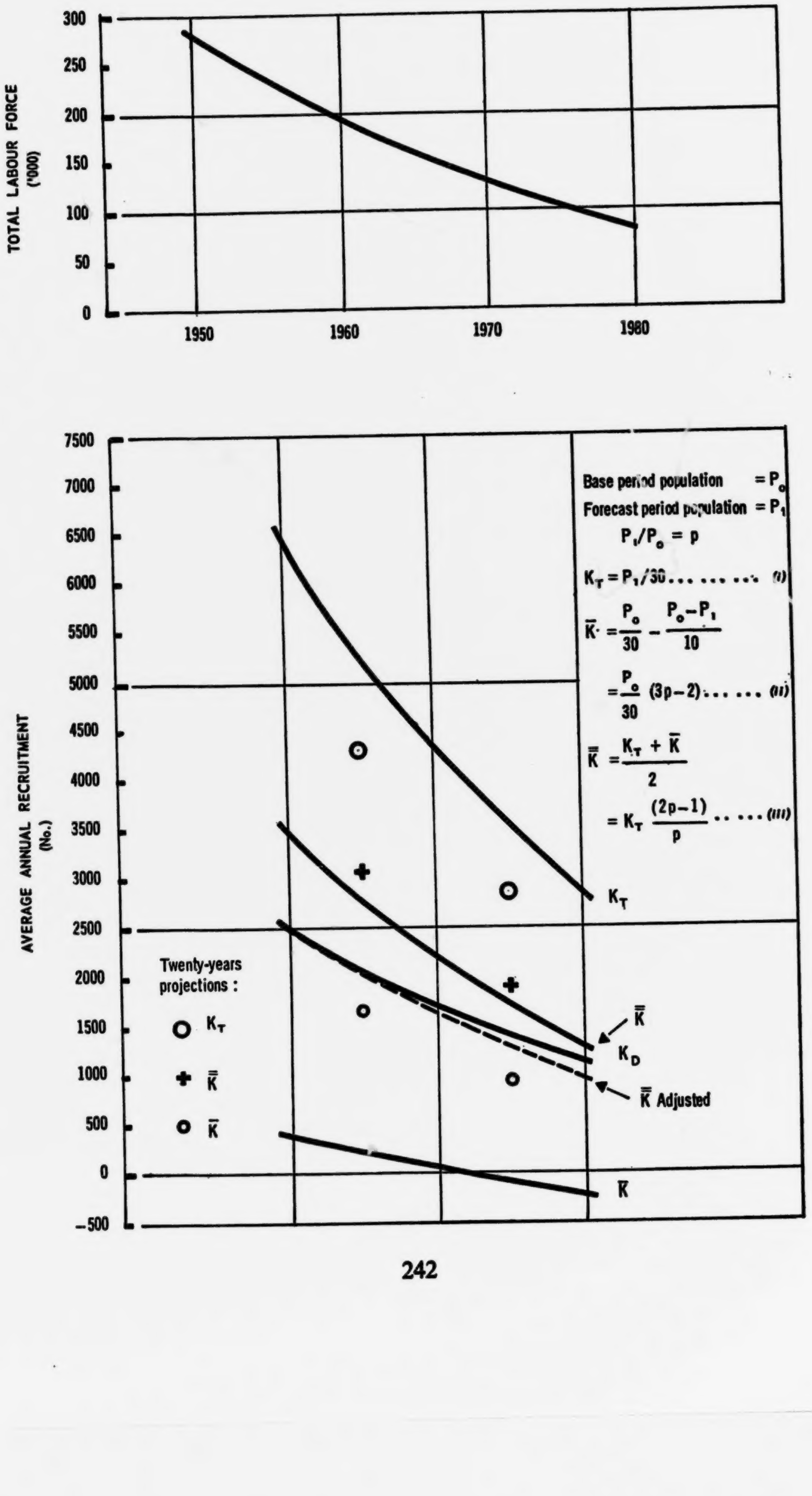
Graph 1. RELATIONSHIP BETWEEN AVERAGE AND TERMINAL RATES OF RECRUITMENT
(20-year projections)



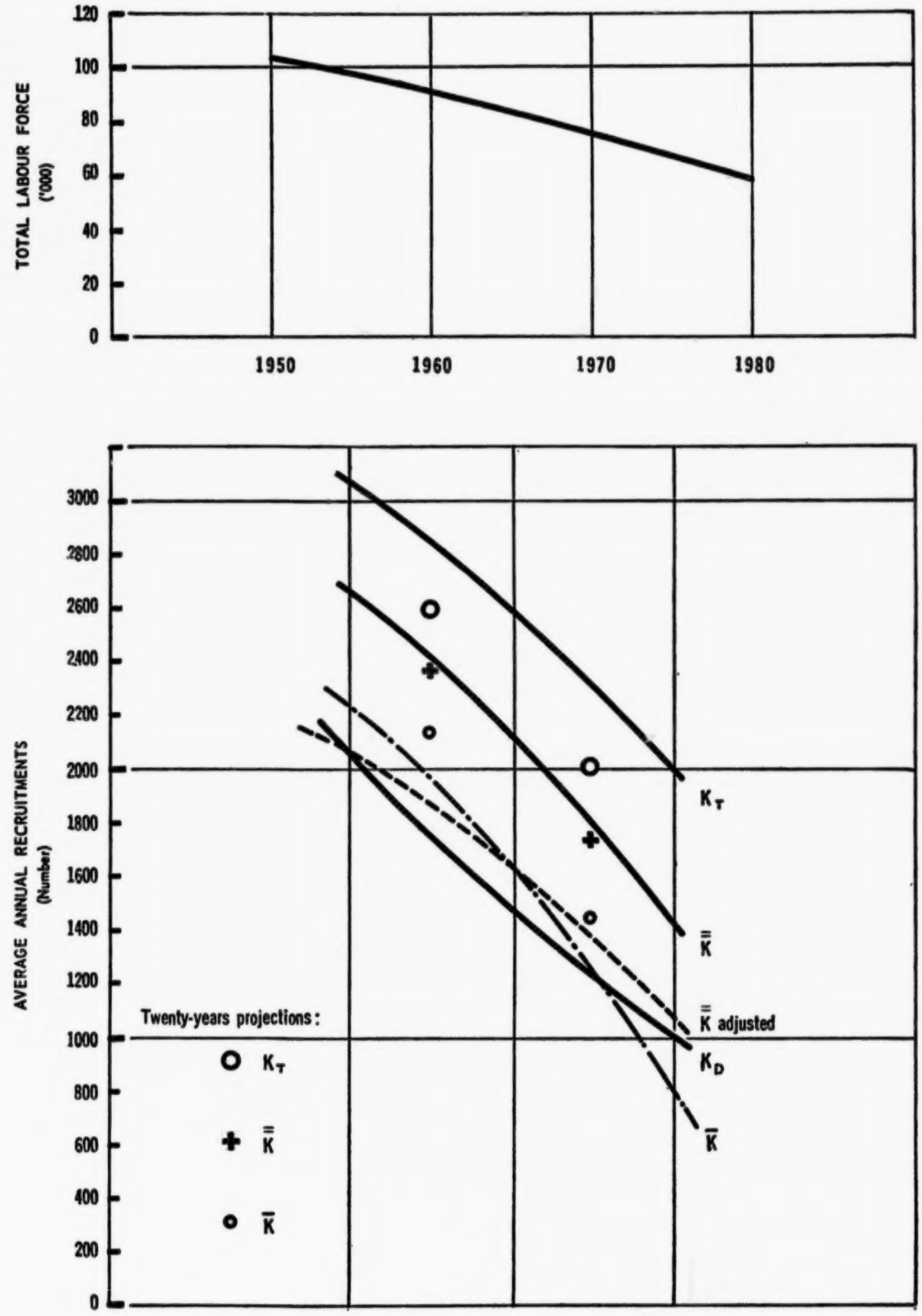
Graph 2. RELATIONSHIP BETWEEN AVERAGE AND TERMINAL RATES OF RECRUITMENT
(10-year projections)



Graph 3. COMPARISON OF DECENNIAL PROJECTIONS OF ANNUAL NUMBER OF RECRUITS (Holdings > 2 ha)



Graph 4. COMPARISON OF DECENNIAL PROJECTIONS OF ANNUAL NUMBER OF RECRUITS (Holdings > 10 ha)



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33. **Catalogue of the types and sizes of wooden packaging for fruit and vegetables used in Europe.** (Supplement to the catalogue published in 1958). Project 5/16 (9 s. – F 6).

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22. **The consumption of fruit and vegetables in OEEC countries.** Project 372/2.

24. **Marketing and distribution margins for milk and milk products.** Project 285.

25. **Standardisation of wooden packaging for fruit and vegetables.** Project 372/2.

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